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CONTENTS

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Specifications of Patents.

Original Communications.

Papers

Papers selected from the Transactions of Philosophical Societies, &c.

Some

Papers translated from Foreign Works.

Precautions

List of Patents for Inventions, &c.

PLATES

PLATES

IN THE

THIRTY-FIRST VOLUME.—SECOND SERIES.

WOOD ENGRAVINGS.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLXXXI. SECOND SERIES. June 1817.

Specification of the Patent granted to John Dickinson, *of the Parish of St. Martin Ludgate, in the City of London, Stationer; for certain Improvements on his former Patent Machinery for cutting and plaining Paper*; and also certain Machinery for the Manufacture of Paper by a new Method.* Dated February 19, 1809.

With Two Plates.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said John Dickinson do hereby declare that my said invention is described in and by the drawings hereunto annexed, and the following description thereof; that is to say: The first part of my invention, consisting in certain improvements in my patent machinery for cutting and plaining paper, is described in the annexed drawing No. 1 †; wherein Fig. 1 (Plate I.) represents a sectional elevation; Fig. 2 a plan, and Fig. 3 a transverse section. Every part in the elevation Fig. 1 is on a line

* Published in Vol. XXX. Page 262.

† In the Plates the distinction of drawings, Nos. 1 and 2, are left out, as the different parts of the invention are sufficiently distinguished by the figures following each other in succession.

with the same part in the plan Fig. 2; and the same parts are represented by the same letters in all the three figures. *a* is a rod, covered with paper. *b* a swinging roller, to draw the end of the paper a little back after it has been cut. *c* a bar, having a groove in its upper surface, into which the circular cutter *d* runs. The bar *c* is moveable up to a certain height, and connected with two arms *x x*, by means of which it may be moved downwards; the springs *e e* will elevate it again when the pressure is removed from the arms *x x*. *f* is a sliding frame, having a pair of tongs attached to the front of it, and marked *g*. The board on which the paper is laid is marked *h*; and on the side next the tongs is furnished with thin teeth *i i*. The frame *f*, which carries the tongs, slides in grooves in the frame of the machine, and is moved backwards and forwards by the rod *j*, which in drawing the tongs from the reel of paper closes them; and in forcing them back again towards the reel of paper, opens them. On each side of the frame *f* is fixed a small roller, which act upon the arms *x x*, so that the frame in being forced towards the reel of paper presses the arms down, and consequently moves the bar *c* down out of the way of the tongs, which at that period are open. The end of the paper is at that time lying even with the extremity of the teeth *i i*, and the jaws of the tongs closing immediately that the rod *j* is put in motion to draw the frame back, seize the paper in every interval between the teeth, and draw it along with them. When they have carried it out the length that the sheet of paper is wanted, the bar *c* having been raised up to its place by the springs *e e*, the circular cutter is thrown across, and as the edge descends into the groove about the sixteenth part of an inch, the paper which is lying upon it is cut through, and the ends fall down upon the

heap

heap below the tongs; being then forced back, and at the same time opened by the rod *j*, the other end of the sheet is released, also the swinging roller *b*, then falls down upon the board *h*, and draws back the end of the paper even with the line formed by the end of the teeth *i*, ready for being seized again by the tongs. The rods *j*, by which the frame carrying the tongs is moved backwards and forwards, has a hook *k*, which can be fixed at any part of the rod by a screw; and the clinck being furnished with pins *m m*, at two opposite points on its surface, these catch the hooks, and draw the rod, and consequently the frame, with the tongs outwards. When the clinck has made half a revolution the hook is stopped by the bar *n*, and the rod and frame remain stationary while the paper is cut. When the pin has got clear of the hook, the rod and frame are immediately drawn back by a weight acting over a pulley, which is connected with the rod by the cord *o*. The circular knife is fixed in a sort of waggon, having four rollers *p p*, by means of which it runs along the beams *q q*. The knife is kept moving at the rate of about five hundred turns per minute, by means of a band passing round the small rigger *r*, and the pullies *s s*, which is kept in motion by any convenient power. The waggon may be thrown across at the proper period by the following method, or any other more convenient. A cord is attached to the waggon, acting over a pulley with a weight at the end, sufficient to draw it across one way with a quick motion; for drawing it across the other way a cord is attached to the waggon, which is carried over a pulley, and fastened to the weight A, in Fig. 4, which is much heavier than the weight before mentioned. The endless band B passes round the rigger D, which is kept in constant uniform motion, according to the rate at which the paper is cut.

The band also passes round the rigger C, which has a click that stops it going round; consequently as the rigger goes on, it keeps winding up the weight A, and the spare band is ingrossed by the smaller weight E, so that when the click that confines the rigger D is removed, the weight A descends and draws it round a complete revolution, when it is again caught by the click, at the same time the weight A draws the waggon across, and it is caught on that side the frame and confined by a click; when the next sheet is to be cut the waggon is released, and the weight attached to it on the other side draws it across again, the heavier weight A being by that time drawn up high enough to allow of its going all across; the two clicks may be contrived according to any common well-known mechanical method, and the motion that releases them can be communicated with the most advantage from the click *e*; the pins *m m* can be fixed in holes *t t*, at a greater or less distance from the centre, according to the size the paper is intended to be cut, and the hook on the rod *j* must be shifted accordingly. A regular motion may be given to the click by any convenient power, and at such a rate as it is required to cut the paper.

The drawing, No. 2, is for the purpose of explaining the remaining part of my invention, consisting of certain machines or machinery for the manufacture of paper, by a new method for that purpose, I take a cylinder constructed so as to possess the following requisites: in the first place it must be hollow and open at the ends; secondly, the surface of the periphery must be like a sieve, with apertures communicating with the internal part large enough to permit the passage of water, but calculated to intercept fibres of rag; thirdly, it must be so contrived that the surface will not yield from its perfectly cylindrical form, notwithstanding a

very

very considerable degree of pressure upon it; fourthly, it must be furnished with broad flat rings for the purpose of covering part of its surface; at the ends there may be several pairs of these rings of different widths, in order to vary the proportion of the surface which is left uncovered, provided the same cylinder is extended for making different sized papers; fifthly, it must be hung upon an axis in a horizontal position, and firmly fixed in bearings, so that it may be turned by any convenient power; sixthly, the numerous small apertures on the external surface must open into a less number of large ones, communicating with the internal surface, with solid interstices between them; seventhly, it ought not to be made of wood because it would be liable to warp, nor of iron because it would rust, and injure the paper; brass or any other strong metal would be found most convenient. I shall now proceed to describe minutely the mode of constructing a cylinder possessing the requisites above-mentioned; the dimensions must be according to the size and thickness of the paper it is intended for making, and I shall give directions on that subject in a subsequent part of the Specification: I take a brass cylinder, perfectly smooth inside and outside, and excepting a small portion at each end which is left plain, I turn the outside so as to resemble a screw, the threads of which are about a quarter of an inch apart, and the twenty-fifth part of an inch in depth, with a round edge. I then drill holes between the threads, which are cut in a taper form, the diameter at top being the width of the interval between the threads, and at the bottom reduced to one half that size; the space on the outer surface of the cylinder, left between these holes on each side, is equal to the breadth of the thread; notches are cut in the threads for the purpose of letting in cross wires, the diameter of which is equal to that of

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the threads, so that when they are laid into the notches and soldered, or otherwise fastened down, the surface of the cylinder will resemble net-work, with openings of an oblong shape; and having the surfaces of all the interstices plane with each other, and wound to an equal curve. It is then covered with an endless web of woven wire, which is drawn tight over it. The ends of the cylinder are cut down, or rabitted, so that a ring may be made to slide on each end; and the ends of the wire are fastened to this ring by means of small plates, which are put over the wire, and screwed down upon the rings by means of screws which pass through the wire. These rings are also furnished with other screws for the purpose of extending them out from the cylinder, and the wire being fastened to them, it is by that means stretched and drawn tight down upon the surface of the cylinder.

In the annexed drawing, No. 2, Fig. 5, *a* to *b* represents a transverse section of a segment of the cylinder C C C, being the holes; *d d d*, the cross wire; *e e e e*, the thread of the screw which is shaded.

Fig. 6 (Pl. II.) is a plan of a portion of the external surface of the cylinder, wherein A to B shews it without the cross wires, or the external wove wire; C C C are the holes, *e e e* the thread of the screw with the notches cut, *a a a*, for the reception of the cross wires, B to C shews it with the cross wires let in, *d d d*, which are soldered or otherwise fastened at their ends into the ends of the cylinder. C to D shews it with the woven wire laid over it, through which the surface of the cylinder is seen underneath.

Fig. 7 is a section of a part of the cylinder at one end, where the holes are marked *c c c*, the cross wires *d d d*, the threads *e e e*; the external wove wire *f*, is represented by a red line, it is carried under the plates *g*, and fastened, by

by means of a number of screws *h*, down upon the ring *i*, which is shaded, and after it is fixed in that manner at each end of the cylinder, the ring *i* may be extended from the cylinder by means of the larger screws R, and the wire thereby strained down tight upon the surface of the cylinder; this part of the mechanism is also represented in the plan, Fig. 6, where the different parts are marked in the same manner, except that the woven wire is drawn in black.

Fig. 8 is a representation of a connected web of laid wire, which may be laid over the cylinder exactly in the same manner as the wove wire, observing that the laid wires should be parallel with the axis, and the tying wires *e e e* at right angles with it, observing that the laid wires must be very fine, placed very near together, and drawn as tight as possible at the ends. The reason of laying the cross wires *d d d* diagonally, is principally in order that they may not be parallel with the laid wires, in which case they would impede the passage of the water; for this reason they ought to lay at an angle as near forty five degrees as may be convenient; but if the cylinder is intended only for the manufacture of wove papers, the cross wires may be parallel with the axis, the holes ranged in rows also parallel with the axis and the threads of the screw converted into small beads; there are other modes of constructing a cylinder possessing the necessary requisites, but I have only thought it expedient to describe that which I consider easiest of construction, most durable and most efficacious in use. I propose connecting the rings mentioned as the fourth requisite, as being necessary for covering part of the surface of the cylinder, completed as above at the ends with arms, so as to form caps that may be fixed on to the end of the cylinder, and each being furnished with an axis, it can then

then be fixed in bearings for the purpose of being turned by any convenient power.

Fig. 9 (Pl. II.) is an outline section, representing it in that situation, with a vessel fixed against it, which I shall call a back; the sides or cheeks of which are curved, so as to correspond with the rings or surface of the caps; and the bottom, at the point *s*, is made to close in upon the surface of the cylinder, so that the vessel on all sides fits the cylinder in such manner, that if fixed against it, and filled with any fluid, the fluid would have no means whatever of escaping, except by running through the surface of the cylinder, and out at the ends: the exact shape of this vessel is not material. I next take a triangular trough, or receiver, closed up at the ends, and made so that the upper edges fit the inside of the cylinder, and of such a depth that the bottom may be about level with the centre of the cylinder, so that this being fixed, and the cylinder turned round, every part of the upper edge may rub against the inside of the cylinder, which I have before said must be perfectly smooth. In Fig. 5 a section is shewn of this trough, which has an orifice at one end, at the bottom, marked *m*. It may be observed, that at the points *n n* it comes in contact with the internal surface of the cylinder.

Fig. 10 is an outline vertical section, wherein the trough is represented fixed in the inside of the cylinder, and coloured blue, with the orifice *m* and pipe communicating with it *n*. It is to be observed, that this trough is firmly fixed by means of a plummer block *o o*, which has the top coupling screwed down fast, and the trough is supported at the other end by means of a cylindrical pin, which works in a hole in the cap *a*. The other cap *b*, instead of an axis, has a hole in the middle, fitted to the outside of the pipe *n*, so that it forms a bearing for that side

side of the cylinder. The axis of the cap *a*, at the other end of the cylinder, is supported in a bearing, and has upon it a cog-wheel *p*; by means of which motion may be communicated to the cylinder, and as it turns round it rubs against the upper edge of the trough, which will remain fixed, and receive any fluid that passes through the upper part of the surface of the cylinder, and carry it off through the orifice *m* in the same section. The cylinder is coloured yellow, the caps red, and the parts which answer to the rings are shaded.

Fig. 11 is a front view of one of the caps.

Fig. 12 (Pl. II.) is a sectional elevation of the machinery, in a state of preparation for the manufacture of paper.

Fig. 13 is a plan of the same. Each part in the elevation, Fig. 12, is on a line with the same part in the plan Fig. 13; and every part is marked with the same letter in both. A is a circular stuff chest; into which the stuff is admitted from the engine. B is an agitator, consisting of a number of arms, connected with a spindle C, which passes up through a tube D, in the centre of the chest, and this being turned by the bevelled cog-wheel E, keeps the stuff in motion in the chest, and also, by means of the two riggers F F, gives motion to another small agitator, in the smaller vessel G, which is for the purpose of receiving the stuff from the first chest, and it is conveyed through the pipe H, the aperture of which is enlarged or contracted by means of a conical valve, which is acted upon by some apparatus I, on the principle of a ball-cock, so that as the vessel fills with stuff it gradually closes the orifice; by this means the stuff in the smaller vessel G may be kept at a uniform height, and the head being uniformly the same, the discharge through the pipe J at the bottom will be always equal. The large chest A may be of any shape or dimensions, and agitated

 in

linder, which is covered with pulp, in the state before described, and thereby rendered nearly impervious to the air. The immediate effect produced is the squeezing out the water, and laying the pulp down in a compact state on the surface of the cylinder, so that the paper cannot be disturbed at the point Z by the pressure of the solid roller *a*. This part of the process I call the *pneumatic* pressure. The periphery of the roller *a* moves it exactly the same rate as the periphery of the cylinder R, and in the direction described in the drawing. The roller *a* is made to fit in exactly between the inside of the caps, described in Fig. 10, so that it shall only press upon the paper covering the surface of the previous cylinder. The surface of the roller A should be smooth, and the paper will adhere to it instead of the pervious cylinder R, and be led round by it to undergo a second pressure between the roller *a* and the roller *b*, which latter has a pervious surface, consequently the paper will be produced sufficiently dry for leading off to the cutting. It is well known by paper-makers that, independent of the quality of the materials, the strength, smoothness, and beauty of papers, depend upon the arrangement of the fibres of rag of which it is composed; that in a well-made sheet of paper the fibres are ranged in a horizontal and parallel direction, and a manufacturer describing such a sheet of paper, would say that the stuff was well shut, which quality all paper must possess in a greater or less degree, because otherwise the parts of the sheet will scarcely cohere together, the surface will be rough, the thickness uneven, and the paper devoid of beauty, and not adapted for use. In the modes of paper-making exercised hitherto, this indispensable object has been accomplished, by shaking the mould or wire on which the pulp is settling, so that as the water runs off, the fibres are laid flat upon the

the surface of the mould, and arranged in a parallel direction; but in making paper by the machinery above described, the stuff is perfectly well shut, without any shaking, the fibres of rag being deposited gradually, in a longitudinal direction, by means of the friction which takes place upon the cylinder, in consequence of its motion being in an opposite direction to that of the stream of pulp, the effect of which is to smooth down the fibres of rag as they are laid upon the cylinder, and it is necessarily continued during the whole time of the formation of the paper, and must be uniform throughout every part of it. The reason of introducing so large a quantity of water into the pulp, is in order that every fibre may be afloat separately, and at liberty to take a direction according to the influence of these courses.

It is to be observed, that the principle here developed would admit of other less eligible modifications, such as confining a body of their pulp on the surface of an endless well of woven wire, carried round cylinders, as in the outline section Fig. 14, or supporting it on a cylinder of a large size, as in the outline section, Fig. 15, without applying the pneumatic pressure in either case.

In Fig. 14 the cylinder *a b c* should be hollow, and have pervious surfaces.

In Fig. 15 the cylinder might be of a more simple construction than that described in Figs. 5, 6, 7, 9, and 10; but unless of a very large size indeed, it could only be made use of for making very thin papers, because the water requires so long time to run off before the paper will admit of any mechanical pressure.

It is to be observed, that in making paper by this method, after a certain quantity of fibres of rag are deposited on the surface of the cylinder, it renders the passage of the water and the accumulation of more fibres so dif-

ficult,

ficult, that without a considerable height of pulp the pressure will not be sufficient to force the water through the cylinder, and the fibres of rag laying upon it, the consequence of which would be, that the fibres of rag accumulated on the surface of the cylinder would be washed off by the pulp, or very much disturbed before they arrived at the point T, which is the level of the pulp in the back; to obviate this, it will be necessary to add the pressure of the atmosphere to the weight of the water in making thick papers, which may be done by extending one side of the trough V below the level of the pulp, so as to cause a suction under that part of the cylinder which is covered by the pulp, as well as under that part which has emerged from it. For this purpose a wider trough would be necessary, but at all events the exact proportion of the cylinder, covered by the trough, is not material, because it will be found by experience what width is sufficient for drying the paper, so as to enable it to have the pressure of the roller *a*. The roller *a* ought to press upon the cylinder R about the point which is over one side of the trough V, and, according as the trough is shifted, the roller should be shifted also; but this pressure ought to be not less than forty-five degrees above the level of the axis, because, otherwise, part of the water pressed out of the paper will be absorbed by it again, whereas, from the position it acts in, in the drawing, Fig. 12, the water will be sucked into the trough. The roller *a* should not be fixed in bearings, but confined down upon the cylinder by weights, suspended upon each end of the axis, which may be adjusted according to circumstances, and in all cases the principal pressure should be upon the roller *b*. The water which runs through the cylinder in Figs. 12 and 13, and out at the end, falls in the first instance into the cistern C, from whence

whence it passes through the pipe *d* into the cistern *e*, and from there is, by means of a pair of double acting pumps *ff*, forced through the pipe K into the vessel L, so that it continually returns for the same purpose of conducting the pulp to the cylinder from the pipe J. The pipe G is a sort of gage, by means of which, after the pulp rises to a proper height in the vessel L, the remainder of the water is carried off into the cistern C, where there may be a waste pipe, for conveying off the superfluous quantity. The water drawn from the cylinder R, through the trough V, by means of the air and water pumps X X, may run to waste. The size of the cylinder R, and of the trough V, must be regulated according to the substance and dimensions of the paper it is intended for making. Fifteen inches will be sufficient for the diameter of a cylinder intended for making paper equal in substance to a paper twenty-two inches by seventeen inches and a half, weighing twenty pounds *per* ream: the length of the cylinder is entirely arbitrary. The thickness of the paper made by a cylinder may be adjusted in various ways: first, by using cylinders of various diameters; secondly, by accelerating or retarding the motion of the cylinder; thirdly, by varying the proportion of the surface of the cylinder, which is covered with pulp; fourthly, by varying the consistency of a pulp, I consider that the periphery of the cylinder ought to move at the rate of about thirty-six feet *per* minute; the pulp ought at all events to be very thin, and therefore that the most eligible mode of adjusting the thickness of the paper would be by varying the proportion of the surface of the cylinder, which is covered with pulp; consequently for thicker papers a larger cylinder would be necessary, or a back may be made use of, extending higher up towards the point Z, so as to cover a larger

pro-

proportion of the surface of the same cylinder: and for thinner paper, a back might be made use of covering less of the cylinder, as in Fig. 15, by means of the cock in pipe J. The quantity of pulp supplied to the cylinder can be adjusted with the greatest accuracy, consequently the thickness of the paper may be preserved uniform, or varied at discretion, provided the thickness of the pulp in the chest A, and the motion of the cylinder R be continued uniform. By means of the gage pipes Q the level of the pulp in the back P can be varied till the most eligible point for the cylinder to emerge from the pulp is ascertained, and the supply of water through the pipe *r* must be adjusted accordingly. It may be laid down as a general rule, that the thicker the paper the higher should be the level of the pulp in the back. In order to close the trough V tight upon the cylinder R, I propose packing it all round the top, where it comes in contact within side of the cylinder, as at the points *n n*, in the section Fig. 5.

The mode of packing is so well known, that I think it unnecessary to give any description, except the representation in the drawing. The friction of the back P upon the cylinder may be taken off by strips of woollen cloth or leather, particularly at the line across from the point S.

Figs 16 and 17 are for the purpose of explaining a more simple mode of construction. A hollow cylinder, with a pervious surface, which may be used in cases when the pneumatic pressure is not applied. *a a a* is the thread of a screw. *b b b* represent cross bars, carried across the internal surface, parallel with the axis. The best mode of constructing it will be to cast a cylinder with the bars in the inside, and to cut the screw deep enough to form an opening between every bar. It should be furnished with cross wires *c c c*, and covered with wove wire, in the

same

Mr. D

Fig. 1.

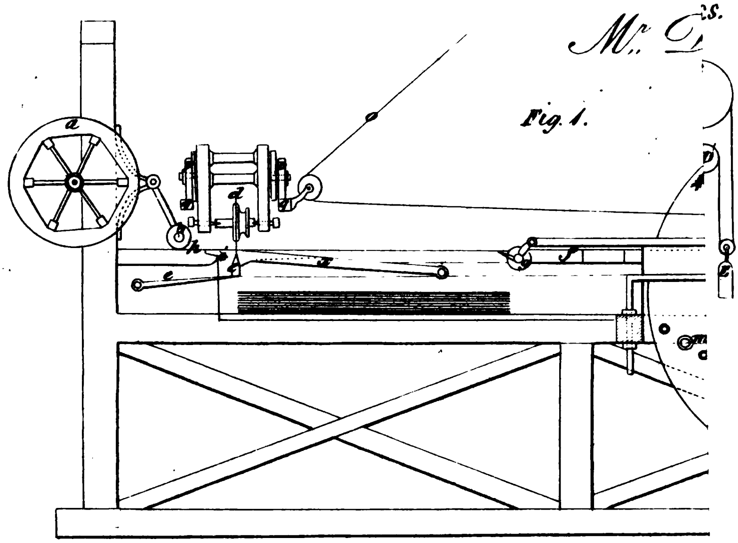


Fig. 2.

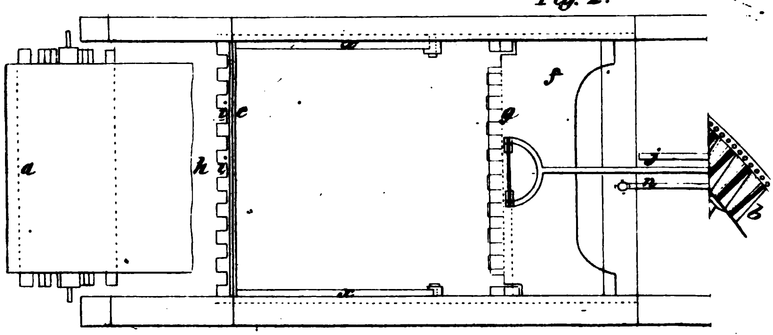
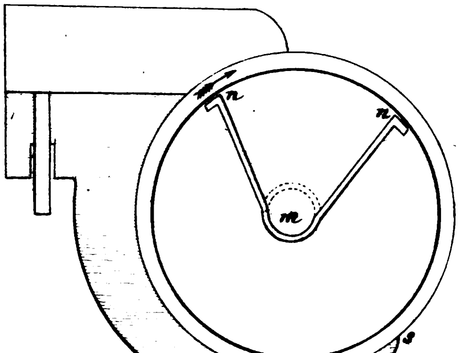
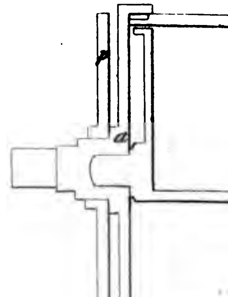


Fig. 9





same way as the cylinder R. It might be made on a larger or smaller scale, according to the purpose for which it is required. The roller *b*, in Figs. 12 and 13, may be made in this manner, but stronger, as a great degree of pressure is intended to take place upon it.

When the machinery is to work, the agitator and pumps should be set in motion; first by turning the shaft K, and then the cylinder R, by means of the cog-wheel P, which gives motion to the rollers *a* and *b*, by cog wheels *q* and *r*. The mode of giving motion, and the situation of the pumps and stuff-chest, may be arranged according to convenience, but the motion ought to be perfectly regular.

In witness whereof, &c.

Specification of the Patent granted to SAMUEL JOHN PAULY, *of Charing Cross, Civil Engineer, and* DURS EGG, *of the Strand, Gun-maker; for certain aërial Conveyances and Vessels to be steered by Philosophical or Chemical and Mechanical Means, and which Means are also applicable to the propelling of Vessels through the Water, and Carriages or other Conveyances by Land.*

Dated April 23, 1815.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, we the said Samuel John Pauly and Durs Egg do hereby declare that the nature of our said invention, and the manner in which the same is to be applied and performed, is particularly ascertained and described as follows; that is to say: It having been ascertained that round bodies are not fit for the purposes of navigation through any fluid, or of floating from one distance to another with any degree of certainty, we adopt a figure

 or

or form, whose farthest extremities may be in an horizontal and longitudinal direction, or nearly so, such as the shape of a fish or bird, as the best and most useful form for an aërostat or balloon, being the best adapted to the purposes of steerage or guidance. Around the lower part or belly of the said fish or bird we fix a frame of wood, or other fit material, well joined together, which we call the head frame, for the purpose of holding the net of the balloon, as well as to hold a ribband, band, or other appendage fixed to the inside of the belly of the balloon, which, in case of accident, by the balloon bursting, will form a parachute, by containing the atmospheric air, as also the different laths, rods, ropes, straps, or other fastenings, by which the gondola, boat, or car, is suspended or fastened. By means of the said laths, rods, ropes, straps, or other fastenings, made of any proper material, we fix the gondola, boat, or car, to the head frame, for the purpose of attaching the different machinery for the direction of the balloon. The fins, feathers, or fans, are made of silk, or any other light stuff or substance capable of acting upon and retaining the air, fixed to a rod or staff, by means of small ribs of whalebone, or any other pliable or elastic substance, placed into the rod or staff, on one side only, like a feather, one side whereof has been stripped of its plumage. These rods or staffs consist of four or more pieces of wood, cane, or other proper material, firmly fitted and glued together, hollow throughout, and tapered off, similar to the rib of a feather. We place five such separate feathers, more or less, as we find it convenient or necessary, on each side of the balloon, to form a wing or wings, about one-fourth part of the whole length of the balloon, from the head or front. And such five of these fins, feathers, or fans, more or less, we unite or place

into

into a head piece or frame, to form a wing, like rays, horizontally, in one plane, alongside each other, so that the silk or feather edge of each is turned towards the tail, or hinder part, and the staff edge towards the head or front part of the fish or bird. This head piece or frame is applied to a strong steel spring, which is firmly fastened to the head frame, playing backwards and forwards horizontally. This spring should be about four feet long, but varying according to the size of the fish or bird, and carries a vertical arch on its extremity, over which the head piece or frame, with the said wings, describes a circle of about 60°, more or less. The fish or bird may be furnished with two or more pair of the before-described wings, as may be found necessary. These wings, acting as before described, will remove, draw, or displace the air from the nose or front part of the balloon, and driving it along its sides to the tail or hinder part in a current, will cause the balloon to move forward. The principle of these fins, feathers, fans, or wings, being considered by us as a very material part of our invention, we think it necessary, for the purpose of rendering them more clearly understood, to explain the principles upon which they act still more minutely. Each separate fin, feather, fan, or wing, has a threefold power, which we call *attractive*, aspiring, or sucking; *repulsive*, driving, or blowing; and *collective* or uniting. When any one of these fins, feathers, fans, or wings, horizontally extended, and lying flat, is moved up and down in a vertical direction, the back or staff edge of it will *attract* the air, or any thing not very heavy, upon which the air may act, suspended on that side, and will repel or drive away from the side of the feather-edge the air, or other matter suspended on this side, and at the same

 time

time produce a strong power on the staff edge side, propelling horizontally forward.

Again, if the feather edge is placed upwards, the staff edge downwards, and the motion is horizontal, the fin, feather, fan, or wing, will be drawn towards the ground; if the fin, feather, fan, or wing, is now reversed, the feather or silken edge downwards, the back or staff edge upwards, and the motion horizontal, the fin, feather, fan, or wing, will produce a motion upwards, or if this tendency or power is resisted, it is evident that the power which is necessary for this resistance is communicated to or experienced by the body by which it is held, or to which it is attached. From the foregoing description of these fins, feathers, fans, or wings, and of the manner of applying them, we imagine that the principle of their construction and action will be very easily understood, and therefore we proceed to the further elucidation of our invention. The tail of the fish or bird which may be adopted for an aërostat or balloon, is made in the same manner, and of the same sort of materials as the said fins, feathers, fans, or wings, but larger, and having feather or silk edges on both sides of the staff or rod, and consists of only two such double feathers. It is fixed to the hinder part of the head frame, and serves as a rudder to steer and guide the balloon. The method of steering requires no explanation, being similar to that used in navigation, which is sufficiently known. The direction of the fins, feathers, fans, or wings, and of the tail or rudder, is given by the aëronaut in the gondola, boat, or car, by means of ropes, levers, or other well-known mechanical contrivances. The aforesaid laths, rods, ropes, straps, or other fastenings, which connect the gondola, boat, or car, with the head frame, and by this means with the balloon, and

and constitute another frame to which the machinery for moving or working the fins, feathers, fans, or wings, and also the tail or rudder is adapted, we do not think necessary to describe, as this piece of mechanism forms no part of our invention, and is extremely simple, and may be made by any practical mechanic in various ways, as circumstances may require; we give the impulse to it either by manual or mechanical means, using in the latter case any first mover which may be applicable to the purpose.

As a further additional means for the guidance and direction of our balloon, we have invented a moveable weight, which will also serve for ballast as occasion may require. This weight consists of a barrel containing water in quantity more or less as may be thought necessary, according to the size of the balloon, provided with a cock, and suspended by ropes or straps which pass over pullies from the gondola, boat, or car, to the end or tail of the balloon, in an inclined direction. When the barrel is suspended in the ropes or straps in the middle of its length of motion, and the balloon is upright or level, if the barrel or weight is moved from the boat towards the tail of the balloon, it will cause the opposite end or head of the balloon to rise and proceed upwards in an inclined direction; and, on the contrary, if the barrel or weight is moved towards the boat, the head of the balloon will sink, and proceed downwards in an inclined course. The water in the barrel which is used as ballast may by means of the cock be discharged, at any time as occasion may require. On each side of the gondola, boat, or car, we also apply one, two, or more fins, feathers, fans, or wings, which are made upon the same principle, and are worked in a manner similar to the fins, feathers, fans, or wings before described, which will enable the aëronaut to ascend

cend or descend at pleasure, without being compelled to throw out ballast, or suffer the gas to escape by opening a valve or valves, or otherwise. Having above fully described the principle of constructing our said fins, feathers, fans, or wings, we do hereby declare, that the same principle is also applicable to the propelling of vessels through the water, to the working of wind or water-mills, and may also be assistant in a great degree to driving carriages and other conveyances by land, and to other useful purposes, hereby reserving to ourselves the sole right of applying fins, feathers, fans, wings, or tails, made upon the above principle, of whatever shape or or form they may be constructed, and in whatever direction they may be placed or fixed, suitable to the situation and circumstances of the case, to any purpose or purposes to which they may be applicable. These fins, feathers, fans, or wings, upon the before-mentioned construction, will also be applied and fixed to a frame or frames, and wheels, for a machine for the purpose of raising and supporting itself in the air, without the assistance of gas, by means of a wheel or wheels, their motion either horizontal, vertieal, or otherwise, and fixed to a frame, to be moved or worked in a circular direction, or otherwise, as may be found best. The impetus to this machine will be given by a fly and fly-wheel, or wheels, similar to those applied to windmills, with the assistance of the well-known mechanism usual to work machinery, or manual labour; an appropriate frame made of wood and canvas, or other materials best suited for the purpose, will form the head, body, and the tail, by which it will be steered.

In witness whereof, &c.

Specification

Specification of the Patent granted to THOMAS ASHMORE, *now or lately resident at Portland Hotel, Portland-street, in the County of Middlesex, Esq.; for a new Mode of making Leather.* Dated September 9, 1816.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Thomas Ashmore do hereby describe and ascertain the nature of my said invention, and in what manner the same is to be performed, by the following description thereof; that is to say: The substances employed by me in preparing leather, and for the application of which to this purpose, I claim an exclusive right during the continuance of this my patent, are, First, all kinds of soot, whether produced by the combustion of bones or of any other animal matters, by the combustion of wood, of peat, or of any other vegetable matters, or by the combustion of coals, of coal tar, of petroleum, or of any other bituminous matters. Secondly; the oils and other empyreumatic liquors, (excepting pyroligneous acid,) whether produced by the distillation of bones, or of any other animal matters, or by the distillation of wood, of peat, of resins, or of any other vegetable matters, or by the distillation of coal, of coal tar, of petroleum, or of any other bituminous matters. Thirdly; all kinds of empyreumatic gases, produced by the combustion or distillation of animal or vegetable, or of bituminous matters. Fourthly; all kinds of liquors in which the above empyreumatic gasses have either been washed, or with which they have in any other way been kept in contact. Not to attempt to enumerate the various ways in which the above-mentioned substances may be employed; to the same end I shall describe those processes which I prefer, and make use of in preparing liquors from soot and from tar, with which I convert skin into leather.

Of

Of Soot Liquor.—The soot of coal, taking into consideration its greater abundance, is upon the whole to be preferred to the soot of wood, or of any other substances. That which collects near the top of the chimney is the best; and that which is deposited nearest to the fire is the worst, being indeed sometimes wholly useless. With every hundred pounds weight of soot, of medium quality, I mix three pounds and a quarter of good quick lime. I put the mixture into a vat, furnished with a cock and a false bottom, and moisten it with cold water. Then I pour upon it boiling water, in such quantity that the whole of the water, hot and cold, shall amount to sixty-two gallons. I let the whole remain for twenty-four hours; after which I open the cock, and receive, in any proper vessel, all the liquor that will run. I then press the residue till I have obtained as much more liquor as I conveniently can. The soot is again mixed with a fresh portion of lime and hot water, either alone or holding in solution; four pounds weight of sal-ammoniac is added to it. After standing for twenty-four hours the liquor is drawn off as before; and this process is repeated till the soot will no longer give a liquor of sufficient value to pay for the expense. The liquors thus obtained may be either mixed together, or the weaker ones may be used instead of water, with fresh parcels of soot and lime, according to the required strength of the liquor; and the first, or the strongest liquor, may in the same manner be rendered still stronger if required.

Of Tar Liquor.—To every ten pounds weight of quick lime I add as much water as will make it fall into powder, and then add twenty pounds of common or wood tar, stirring the mixture till the ingredients appear to be well incorporated. I then add one hundred and forty gallons of boiling water, having previously dissolved in

it twenty pounds of coarse sal-ammoniac. The mixture is then well stirred several times; and after standing for twenty-four hours is separated from the sediment, and forms tar liquor. Soot liquor and tar liquor may be made by mere infusion of soot and of tar in hot water; and these liquors will convert skin into leather, but are too weak for most purposes. A stronger liquor may be made by using quick-lime together with the water; but the best liquor is made in the manner already particularly described.

In order to make leather by means of the above mentioned liquors, I separate the hair from the skin, and work it on the beam in the usual manner; after which, instead of putting the skin into the tan-pit, I place it in a vat, or other vessel, and cover it with soot liquor or with tar liquor, care being taken that the liquors are first rendered clear by filtering through sand, or by any other convenient method. I allow the skin to remain in the liquor for twenty-four hours, more or less, and then transfer it to a vat of lime and water, where it remains for twelve hours. After this I again remove it to the soot or tar liquor, and continue this alternation till the skin is completely tinged through of a bluish brown colour; the time required for this depending on the thickness of the skin, the strength and temperature of the liquor, and other variable circumstances. The skin being advanced to this state, I remove it from the liquor, and expose it to a current of air, in order to dry it. I then immerse it for forty-eight hours, or more, in the soot or tar liquor, and immediately after, for an hour or two, in lime water; then again dry it, and thus give it alternate dippings and dryings until the skin is completely converted into leather. It is then finished in the usual way.

In witness whereof, &c.

On the Cure and Prevention of Dry Rot in Ships of War.

By Mr. GEORGE OGG, *Salt Refiner, Plymouth.*

Extracted from a LECTURE read at the PLYMOUTH INSTITUTION.

WHEN dry rot in ship-timber was less prevalent than it now is, perhaps it excited greater alarm. It is at this time so common and widely extended, and its destructive progress is accounted so irresistible, that there is danger of its being looked upon with apathy and indifference, as we learn to look on other evils which seem to admit of no remedy.

For several reasons, the subject demands peculiar attention at this particular period; and as every inhabitant of Britain is a party concerned, so every one has a right to enter into the investigation. The urgent demands of long-continued warfare have so thinned the woods and forests of this country that serious difficulty is, I understand, experienced in obtaining a sufficient supply, particularly of large timber. The present low state of our national finances stamps with additional importance every project that is calculated to check farther exhaustion; and, above all, there are well-grounded fears that the ravages of this silent but powerful enemy, in times of peace, may prove more injurious to our wooden walls than the efforts of all other enemies in time of war.

The Stirling Castle, Armada, Rippon, Indus, Hannibal, Mulgrave, and Poictiers, may be stated as fair specimens of a large number of third rates, built but recently; of these mentioned, several have been almost rebuilt, and the remainder are to be so as soon as possible. The San Domingo, another of them, being accounted unworthy of repair, has been broken up. The Eurotas,

Cydnus,

Cydnus, Araxes, Alpheus, Hebrus, Granicus, and Meander, are some remains of a whole class of frigates, built of fir, even more recently than the third rates, before mentioned; by far the greater part of this class is already lost to the service, being either broken up or sold as unserviceable. The Eden and the Mersey, never yet used as ships of war, have shown strong symptoms of decay. The Queen Charlotte was found in such a state, soon after she was launched, that it was necessary to give her immense repairs before she could be fitted for commission; and the Dartmouth is now in a state of complete decay, although she has never been at sea. Add to this the high testimony of Mr. Pering, a gentleman whose correct knowledge, patriotic zeal, and useful inventions, are well known to my audience, and the British public: he asserts, in his "Brief Enquiry," that the "average duration of the navy itself may be said to be limited to eight years."

That species of decay called Dry Rot in houses, appears in general to differ considerably from the disease of the same name in ships; it is to the latter alone that I am prepared to request your attention.

Dry rot is usually discovered by the appearance of a soft, white or brownish, leathery, fungous looking substance, on the surface of timber; often where it is cut across the grain; and, on close inspection, this substance appears to be the aggregation of innumerable little tubes or fibres of the same nature, proceeding from the pores of the wood. Sometimes, the timbers are found to be infected only in part, the disease generally proceeding from the centre outward; others are entirely decayed, and, though possessed of an external appearance of soundness, are ready to crumble to dust on being touched.

The causes of this decay, and of these appearances,

have been explained and illustrated, in a very admirable manner, by Mr. Bowden, in his treatise on this subject; to which I shall often have occasion to refer. The natural juice of the wood he calls the pre-disposing, and heat the exciting cause of this decay, which, when united, and favoured by some other circumstances, such as a small degree of moisture, are, according to him, sure to produce dry rot. The natural juices left in the timber, excited by heat, and assisted by these circumstances, obey the law of their nature, and make an effort to vegetate, which, not being able to produce buds and branches, in that situation terminates in a fungus; and this fungus, deriving its nourishment from the parent beam, encreases at its expence, and prospers to its destruction. The heat of a crowded ship, although it may hasten the progress of decay, does not seem indispensable; it having been shewn that some ships have been greatly injured without ever being used.

In proof of this theory Mr. Bowden argues, that as the fungus found growing on decaying oak trees, agrees in its nature and appearance with the known properties of the juices of that timber, it must be thence derived; and that there is a great resemblance between this fungus and that which grows on wounded parts of oak trees, which is evidently produced by the sap, when interrupted in its natural course. Mr. Bowden also remarks that those parts of a ship which are most exposed to heat, and least influenced by a circulation of air, as the magazine and bread-room, are the parts near which the wood is generally most affected.

It is generally admitted that the substance found pervading the pores, and covering the surface of deeaying wood, is of vegetable origin; that this vegetation usually commences in the interior of timber, and is the cause of its

its rapid decay. This is sufficient to point out the nature of the remedy to be applied. The vegetable juices must be expelled; or they must be confined, so as to render it impossible for them to act; or their vegetative powers must be entirely destroyed. A great variety of remedies have at different times been proposed, some of them calculated to accomplish the object in every one of these ways.

The first that I shall mention is of great utility, and easily managed, but is not, perhaps, to be entirely depended on; I allude to felling the timber in winter, before the juices ascend. The propriety of this plan has long been known and admitted; but numerous circumstances combine to prevent it from being acted upon; the chief of which is the superior value of the bark in spring. It is possible, however, by barking the tree in spring, and felling it the following winter, to reconcile the utmost profit with the highest utility. But it is to be feared that this desirable mode of improving timber will never be fully adopted; as a very large proportion of wood is known to be cut on the spur of the occasion, and on account of the scarcity, it is sure to find a ready sale, though felled in the very worst season.

Another mode of improving timber that has been practised with advantage (although I am inclined to think under an erroneous idea), is by steeping it in sea water. It is supposed that the salt of the sea water tends to preserve the timber; but of this I am very doubtful.

It is known that a small portion of salt hastens putrefaction, and it would appear that sea water possesses exactly that quantity, for it is well known how very soon water taken out of the sea becomes putrid. It is also well known that sea water is incapable of preventing vegetation, as there are large tracts of land covered with verdure,

verdure, although periodically overflown by the tide. Where then shall we find preservative powers in sea water? except in that quality which it possesses in common with fresh water, of dissolving and washing away a portion of the vegetable juices.

Before I pass on to notice the applications that are calculated to confine the juices, I shall just advert to two classes of remedies which cannot be ranked in either of those divisions. I allude to ventilation, and to every kind of substance applied only to the external surfaces of timber. With respect to the former, it may be beneficial in some degree where it is possible to apply it; yet under some circumstances it has been found to promote the disease. Respecting every kind of external application, I am of opinion that they cannot reach the source of the evil; for as the disease is generally found to be an internal one, we can scarcely suppose that any application, made at the surface only, can effectually extend its influence to the centre.

It is not surprising that the superior durability of wood, containing large portions of resin and oil, should have suggested the plan of impregnating timber with those substances, in order to preserve it.

Wood, saturated with resin, would be very durable indeed, but its saturation would be difficult to accomplish; and the expence would be so great as to make the remedy nearly as great an evil as the disease. The method which Mr. Wade recommended for this purpose was to dissolve common resin in a solution of caustic alkali, into which solution, either hot or cold, timber, in a very dry state, was to be immersed; and afterwards plunged into sulphuric acid, much diluted with water. Now supposing resin to be 8*l.* sulphuric acid 40*l.* and potash 60*l.* per ton, which are near the present prices, it will be

evident

evident that a ship prepared in this way would cost an immense sum.

Oil, though not so good a remedy as resin, would prove a powerful preservative. Vegetable oil, particularly linseed, would be the best for this purpose; but nothing less than complete saturation could, I think, be depended on; and this would be by far too expensive to be practicable.

Boiling in animal glue has been recommended; but supposing this to be found useful, an objection similar to the last would lie against it.

The third class of remedies, or those which are capable of destroying the juices, comprehends the acids, alkalies, alkaline, earthy, and metallic salts; nearly all of of which might be made useful, in some degree, for the preservation of timber. To the application of many of them, however, there are insurmountable objections. Some, at the same time that they destroyed the juices, would act upon the ligneous fibre, and injure the timber itself. Some would be unwholesome, and by far the greater part would be too expensive, even if it should be proved, after a sufficient trial, that any of them could be depended on.

Mr. Ogg then enumerates the various substances which have been recommended for this object, and states his objections against each, and proceeds thus:

The requisite qualities of a perfect remedy for dry rot, are, that it should be cheap, wholesome, easily applied, incapable of producing any injury, and fully adequate to effect the entire destruction of the vegetative principle.

Can it be believed that our happy isle possesses inexhaustible mines of a substance, in which all these qualities are inherent, while our ships are rotting, with such fearful rapidity, as to excite apprehensions, in the minds

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of some, that our naval greatness must suffer. Yet this is true. This inestimable substance is common salt, and perhaps I cannot better point out its merits, than by considering them separately, in the order which I have stated.

It is cheap. A few words will prove this. One ton of rock salt, at the mouth of the mine from which it is raised, costs twelve shillings; but it is immediately charged with a duty of thirty pounds, this is the secret of its apparent high price; but Government need not pay duty.

It is wholesome. A salt mine is perhaps the only one that can be descended into with great pleasure; for, independent of the grandeur of the scene, every thing is so clean, the air is so pure, and the people look so healthy. It is a general opinion, where salt works are numerous, that to be engaged in them is the same as to have a very long lease of life. I can state from my own experience that the people employed in my manufactory are particularly healthy; most of them have been there a long time, and some were far from being healthy when they came; this would appear the more striking, could I state what extremes of heat they are obliged to bear, what sudden transitions to cold, standing days together in strong currents of air, continually enveloped with steam, and often working all night under these circumstances. Yet they are healthy.

This remedy is easily applied. Nothing more is necessary than to steep the timber in a saturated solution of it. A single log or plank, the frame of a ship, or a ship itself, may all be immersed in it with nearly equal ease. In this way dry rot may be exterminated at once. Let every ship in the Navy be immersed a sufficient time in this fluid, and let every new ship be prepared in the

same

same way, and dry rot will be heard of no more. But how is this to be accomplished? I answer, provide a dock or docks sufficiently capacious to receive five, ten, or twenty ships, and the work is done. Our age and country are famous for splendid docks: here is a grand opportunity for erecting a more splendid and useful one than ever was thought of before; and I feel convinced that this would be a better speculation to the state, than either the West India or the London Docks have proved to their proprietors.

But it may be objected that this plan is impracticable. I do hope, however, that such an idea as this cannot take lasting hold of any mind. It would be strange, indeed, if it should be found more difficult to confine a pool of brine, than to erect a barrier to the waves of the sea in the midst of its own territory. The subject has cost me some thought, and, were it consistent with the object of this lecture, I could, perhaps, shew that it is practicable, and that it would not cost a sum at all commensurate with the advantages likely to be derived. I am aware that the responsibility of expending money on a plan not sufficiently tried, would be great; and, as was once judiciously observed to me, by a gentleman high in office, it is impossible that Government could proceed with such an undertaking on the *ipse dixit* of any individual. If this plan did indeed rest upon my mere *ipse dixit*, it might probably be unworthy of notice; but, perhaps, I shall be able to shew that it is built upon facts, and the general experience of ages.

I have purposely avoided detail respecting the various modes by which a first trial of my plan might be made, in a small way. My reason for this is, that I hope to produce sufficient proof that it would answer to induce a trial upon a great scale, for the sake of ships now ex-

 isting,

isting, in which dry rot has already commenced its rapid work of destruction. Gentlemen connected with the Navy know how large a proportion of it comes within this description; and that in a very few years, all the ships that are affected must perish, unless some effectual antidote can be speedily found, and generally applied. I will, however, just mention one method of applying the remedy to small ships, in a ready way, that has been suggested to me by a friend; it is by converting one ship into a dock to receive another, which, when properly secured, may be filled with brine, and kept afloat. A frigate or smaller vessel might, I think, be immersed in one of the docks which we have at present, with some few additions to adapt it for that purpose.

It is not, I believe, pretended that there is any remedy known, capable of arresting the progress of dry rot in a ship already infected, unless it be to cut out the diseased parts; and it is lamentable to think how ineffectual this costly expedient has been found. I affirm that dry rot is occasioned by the vegetative principle—brine will destroy this principle—then sink the ship in brine. Can any thing be more simple or obvious than this?

This remedy, properly applied, is incapable of producing injury. Here I take ground which I may not hold without contending for. It will make the ship damp! it must make the ship damp! exclaim ten thousand voices; and naval gentlemen shudder at the idea of a ship streaming with water. It is true that an increase of dampness would be occasioned by salt, of the common quality, but as soon as the salt near the surfaces of the inhabited parts of a ship should be abstracted by the moisture of the atmosphere, or by frequent washings, this dampness would almost cease. Admitting, however, for the sake of argument, that the ship would always be

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more damp, it is far from being clear that this circumstance would be injurious, as medical writers, on the diseases of seamen, are themselves divided on this point. The opinion of Dr. Trotter, published in 1803, that dampness of every kind and degree is highly injurious, has been ridiculed and controverted by Mr. Johnson, in his essay dated 1813. If the very prejudicial effects, likely to result from the exhalations of a rotting ship be taken into the account, I think, we shall have an evil to balance, if not to outweigh, the dampness likely to be occasioned by immersing a ship in brine. But there is no necessity that the ships should be rendered damp by this application. It is not salt that is the cause of this dampness, but the impurities with which it is contaminated. As salt is seldom seen pure, it is never known, except to a few, that it can be so; this is the source of that prevalent error that salt must produce dampness. "Muriate of soda is not deliquescent when pure." Nicholson's Chemical Dictionary. I might easily multiply chemical evidence of this fact, but this will suffice. I may state, confidently, that it is possible to apply the salt of sufficient purity to remove entirely this cause of objection, and that at a small increase of expence. Another deep-rooted objection is, that salt would corrode and destroy the metals. There seems, however, to be no good reason to fear that ships will be found unexpectedly falling to pieces from this cause. I am warranted in stating that iron imbedded in timber, that is saturated with salt, is very little acted upon.

[Here Mr. Ogg exhibited proofs that iron was very little affected by salt.]

There is now but a small proportion of iron fastenings in ships of war; and it is the property of copper, when acted upon, to form a substance on its surface, that pro-

tects it, in a great measure, from further injury. If iron can resist, surely there is no danger that copper will yield. I have never heard of ships employed in the fisheries, or in carrying salt, being rendered useless from this cause; though such a circumstance seems much more likely to happen to them than to a king's ship.

Although I think it would be by far the best way to leave the timber of ships saturated with salt, I do not consider this to be absolutely necessary; and this opinion is founded on reason and experiment; for if salt be capable of destroying the vegetative powers of the juices, this destruction will be accomplished almost as soon as they come into contact; and therefore, the salt may be washed out with safety.

I have now arrived at the last particular in my enumeration of the good qualities of muriate of soda, as applicable to the prevention and cure of dry rot, namely that it is fully adequate to effect the entire destruction of the vegetative principle, and, consequently, to preserve timber.

That salt has been considered in all ages and most parts of the world, as unfavourable to vegetation is almost certain.

It is very generally known and admitted that vessels employed in the fisheries, and in carrying salt, are never infected with dry rot; and Mr. Bowden states the case of some ships, employed to carry salt fish, in which some of their timbers were incrusted with salt and some not, the salted parts had lasted many years, and seemed as if they would last a century longer, while other parts, where the salt did not touch, were decayed.

If the effects of salt, when imperfectly applied to the surfaces of timber, be found so beneficial as to produce

a general

a general conviction of its utility, how much more beneficial may it not prove when applied, in a perfect and scientific manner, to every fibre and every pore!

Here is a remedy already tried and approved; all others compared with this, are merely theoretical. I will not presume to say that something better will never be discovered, but I assert that there is no time for delay, the occasion is urgent; and to effect a cure by medicine which may not seem altogether palatable, is surely better than to let the patient die, while waiting until a more agreeable application is invented.

Permit me now to read an extract of a letter received some short time since from a gentleman connected with the salt works at Northwich, in Cheshire. This is the place where mines of rock salt are wrought, and where an immense quantity of salt is made from brine springs.

"In reference to your enquiries respecting the power of salt in preserving timber, I shall feel much gratified in conveying to you all the information within my reach. Oak timber has been used, at this place, from a very remote period, in making frames for the different brine pits which have been sunk; and, whenever there is occasion to take up such timber, we invariably find it in a very high state of preservation; and this, we consider, proceeds from the timber being saturated with brine. We have also a strong proof, in our wooden pipes, which convey the brine from the cisterns to the pans, which are equally saturated with salt, and are preserved in a like manner. Indeed much timber is used about salt works for various purposes, and I believe, in all cases where the timber comes in contact with either salt or brine, the result is the same as I before stated. Of late years, much deal timber, as well as ash, elm, poplar, &c.

&c. have been used by the salt manufacturers, and the effect is found to be the same as with oak."

I would just remark, on the concluding part of this letter, that it appears, by the experience of the writer, to be proved, that the inferior and less durable kinds of wood are made equal to oak, in durability, when saturated with salt.

I have instituted a course of experiments on timber, with a view to watch the progress of dry rot, and to become better acquainted with the nature of the fungus, occasioning that species of decay: but these experiments are not yet in such a state of forwardness as to admit of any conclusions being drawn from them. I shall mention one experiment, which confirms the opinion that salt is capable of destroying the vegetative principle. In the beginning of October last, I steeped some cuttings of willow in brine; and some in lime-water thick with lime for two days: I then planted them in a hot house; in one month the cuttings which had been steeped in lime-water had put forth branches and leaves; but those that had been steeped in brine continued five months, when they were taken up, without exhibiting the least symptoms of vegetation; those that grew and those that did not grow are upon the table. At the same time I moistened some earth, in two flower pots, with strong brine, and put in some sweet pease and some nasturtium seeds; they have remained in the hot house to this day, but none of the seeds have vegetated, except one solitary nasturtium, which being close to the side of the flower pot, seems to have nearly escaped the salt, but it is feeble, makes very slow progress, and I soon expect to see it droop and die.

An essayist, in the Monthly Magazine, objects to the use of salt for preserving ships, evidently mis-

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taking its real qualities. Indeed, it is not a little singular that he mentions a circumstance which, if true, and of its truth I have no doubt, is abundantly sufficient to shew that his objections are not well founded. He says, that in the Hungarian salt mines there are pillars of wood supporting the roofs, that have borne their load for many centuries, preserved and strengthened by being saturated with salt. In speaking of salt, however, it would seem that Mr. Randle takes that portion of salt which is found in unconcentrated sea water for his standard, although he speaks of salt generally; this is very inaccurate, as a saturated solution of muriate of soda is very different indeed from sea water.

I have made some enquiries concerning the decay of timber, saturated with salt, but I have never been able to hear of any other decay except what was occasioned by wear and tear; and I can scarcely conceive any other possible.

It cannot be doubted that the introduction of a large proportion of solid matter into the tubes of which timber is composed, would impart additional strength and firmness to the body. The difficulty of working wood saturated with salt is very great; hence, timber prepared in this way would be less liable to break or splinter, and would greatly increase the strength of a ship built with it. A ship prepared in this way would harbour none of the vermin, with which ships are usually infested; and every part of a ship, saturated with salt, would be greatly secured against danger of fire; such wood being very difficult of combustion. In short, this method, by increasing the durability and solidity of timber, and rendering it nearly incombustible, seems to unite, in one mass, some of the best qualities of wood and stone.

Thus

Thus it has been attempted to shew, that of all the substances which have been thought of as specifics against dry rot, only one is stamped with the approbation of experience—that there is no mystery in the preservative powers of this substance, the nature of the remedy being admirably adapted to that of the disease; and, to every reflecting mind, acquainted with these circumstances, it would appear infinitely more surprising that those beneficial effects should *not*, than that they should *be* produced. It has also been shewn that this important remedy possesses every requisite good quality, cheapness, wholesomeness, and facility of application.

Surely then, unless what I have advanced in its favour can be disproved, it demands immediate attention. It has hitherto been deemed impossible to immerse a ship in any other fluid than sea water. Mr. Bowden says, "*It must be evident* that a fabric of such magnitude cannot be immersed in any fluid except sea water, so it is equally plain that none is calculated to produce such beneficial effects." Here are two assertions, both of which are decidedly erroneous, for it *is* possible to immerse ships in other fluids, and sea water is very far from being the best for that purpose.

To apply the inestimable remedy, which I have pointed out, would require extensive erections. A bason or dock for immersion, with all its train of appendages; but these once erected, the expence would be trifling indeed; and it must not be forgotten that the object sought to be attained is of the utmost national importance.

Who would not rejoice to be instrumental in counteracting an evil of such magnitude? I feel warmed and animated at the thought; and I seem to behold, by anticipation, our Hearts of Oak infused with the substance

of

solid rocks, formed into floating bulwarks, and directed by *undiminished* bravery and skill, opposing barriers to the enemies of Britain, like those which the strong foundations of our isle present to the attacks of Time.

On introducing extensively the Importation of Cocoa Nut Oil from the Isle of Ceylon.

By THOMAS HOBLYN, *Esq. of Sloane-street.*

With a Wood Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal was voted to Mr. HOBLYN *for this Communication.*

AS the advantages of the cocoa nut oil, which has been lately introduced into this country from Ceylon, in consequence of my suggestion, may not be so well known as it merits, I have sent to the Society various specimens of the oil, in its natural state, and in combination with substances now in common use, such as wax, spermaceti, &c. I have no doubt but that it may be very advantageously employed as a substitute for spermaceti oil, as it is considerably cheaper, burns with a clear bright flame, and is devoid of either smell or smoke. In using it in lamps, however, it will be necessary to render it previously liquid; but its own combustion will afterwards generate a sufficient portion of heat, to allow of the capillary attraction going on without further trouble. It will be found useful also in the manufacture of soap, candles, and the finer articles of perfumery, and become in future a source of great revenue in the island of Ceylon,

and of great importance to this country, if its preparation be more carefully attended to in the plan I have suggested, of breaking up the nuts with edge stones, then pressing them immediately, when reduced to a pulp, and boiling and skimming the oil, and placing it in close vessels, for the purpose of being conveyed to this country. This mode of proceeding will not only render it more pure, but prevents its rancidity, and considerably lessens the leakage, which takes place from using common casks.

The vessels in question, I have had made after the model of the water tanks now employed in the navy, which contain about two tons each.

CERTIFICATE.

I do hereby certify, that under the authority vested in me by the Lords Commissioners of his Majesty's Treasury, I have disposed of one hundred casks, containing about twenty tons of cocoa nut oil, lately imported from the island of Ceylon, in the Emma and Monarch transports, which importation took place by way of experiment, on a suggestion from Mr. Hoblyn, the Deputy Agent of that island; and from the experience of the manufacturers to whom the same has been sold, it will be likely to be attended with great utility and public importance.

London, April 12, 1815. W. HOWARD.

*** The following articles were sent to the Society from Mr. Hoblyn, and specimens of them placed in the Society's Repository.

No. 1. Cocoa nut oil in its common white congealed state.

2. A

2. A composition of half oil and half spermaceti.

3. A composition of half oil and half white wax.

4. A composition of one-third oil and two-thirds wax and spermaceti.

5. A candle formed of the last composition.

6. Cocoa nut oil soap in its crude state perfumed.

7. Cocoa nut oil soap prepared and scented.

8. A solution of cocoa nut oil soap in alcohol, useful in shaving the beard.

From further information given by Mr. Hoblyn, it appears of great consequence to Government, to produce freight from the island of Ceylon, now in their hands. That cocoa nut oil will immediately furnish them a remittance of 50,000*l.* annually, and could be much extended. That 150 casks had been lately imported at so low a rate as to be sold by Messrs. Hendrie, perfumers, in Tichburne-street, at 6*s.* *per* gallon. Mr. Hoblyn added, that cocoa nut oil is likely to be in demand, on a very extensive scale, as he has already had an offer for 100 tons of it.

Mr. R. Hendrie attended the Committee, and stated, that he had made three or four tons of cocoa nut oil into soap; that it makes a sweeter and purer soap than the tallow usually employed in making soap. That soap can be made cheaper with this than olive oil, and that it will cost about ten *per cent.* more than tallow soap. That cocoa nut oil burns very well in the Liverpool lamps, and gives a beautiful brilliant light without smoke, and that he has reason to believe it will be very advantageous to the woollen manufactory.

Reference to the Engraving.

Fig. 1 shows a section of the machine cut through its centre.

Fig. 2 is a plan of the whole machine.

The machine is mounted on a carriage with four wheels, A A A A.

B, the pole by which it is to be moved.

C, the hopper, which conducts the kernel to the cylinder to be ground.

D is the cylinder, covered with plates of iron, perforated after the manner of a grater. At the ends of the axis of the cylinder are found two handles E E, to turn the cylinder, and there is a fly-wheel F, to regulate the motion of the cylinder.

G is a piece of wood, fixed to the back part of the hopper, so as to make an acute angle with the cylinder.

As the kernels are ground or grated by the motion of the cylinder, they are at the same time pressed down to the bottom part of the angle, which keeps them close to the cylinder, till they are all reduced to a pulp.

The pulp is conveyed to the sluice H, and then taken to the box K, for the oil to be pressed out.

K is a square box, with a great number of small holes to let the oil escape into the case L L, that surrounds the box, and conveys the oil to the sluice M, Fig. 2.

N O is a lever, moveable on a fulcrum at N, to press the mallet P into the box. At the other end of the lever is fixed a pulley Q. One end of a rope is fixed to the fore part of a carriage; the other end goes over the sheave or block, and is made fast to the roller R. At the end of the roller is fixed a catch wheel S, with a catch to keep the rope firm. At the ends of the axis of the roller is fixed a cross V, or levers for turning the rollers. T T T T is a box, or cart, for holding the nuts, or any tools that may be required.

Fig.

Fig. 1.

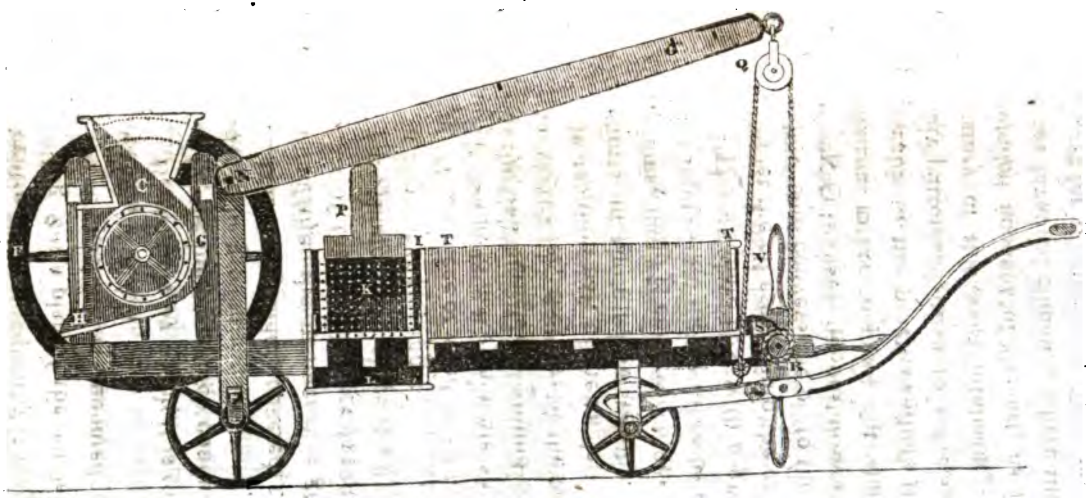
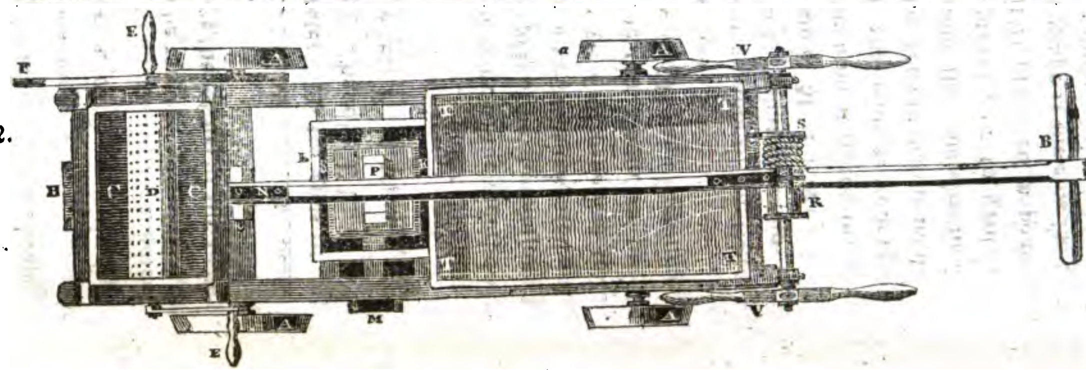


Fig. 2.



By Mr. Hoblyn's apparatus, three parts of the labour now employed in the manufacture of the oil may be saved; and consequently it may be afforded at a cheaper rate.

*** From subsequent experiments, it appears that the cocoa nut oil soap may be used to advantage for medical and surgical purposes, in place of the foreign olive oil soaps, and that the oil is superior to tallow for use in enamellers' and jewellers' lamps.

Hints on the Processes of British Wine-making.

By Dr. MACCULLOCH, *Woolwich.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

IN compliance with the wishes of some of the members of the Caledonian Horticultural Society, I have attempted to sketch the general principles and practices used in the manufacture of wine, with a view of assisting the efforts of those whom the Society, by its annual premiums, has encouraged to cultivate the art of making this liquor from fruits of domestic growth.

In laying down these rules, and in describing these usages, I have been chiefly careful in selecting, and solicitous in enforcing, those which could most readily be brought to bear on our domestic manufacture; being desirous rather to point out such analogies as were applicable to the practices which the Society has so laudably patronized, than to enter either into the chemical history of this most interesting process, or to give a detailed account of the art, as it is practised in those more favoured climates, where the grape is the sole fruit in use for this purpose. The magnitude of the subject would have otherwise led me into discussions, of a

length

length incompatible with the limits of the Society's publications. In condensing and abridging the materials originally collected for this purpose, I have perhaps reason to fear, that I have omitted matters essential to the perfect understanding of the subject. Yet I hope that I have not neglected any thing which will prove a material want, in reducing to practice the views which I have held out, and that some light, however feeble, will be afforded to those, who have hitherto been guided by rules of a dogmatical and positive nature.

It is evident that, in the complicated process of fermentation, some rules should be laid down as the foundation of our proceedings, and the test to which we must have recourse in examining the accuracy of our manipulations. I cannot too strongly enforce the necessity of familiarizing ourselves with general principles, which alone can assist us through the obscure paths, which this, as well as every art connected with chemistry, is obliged to pursue. And it is the address displayed by the artist in converting these general principles to his changing processes, that will give him a certain preeminence over those who are governed by invariable rules. In fact, however these rules may appear fixed, they cannot be generally applied, because, under the mutable circumstances in which the application is made, they must frequently be rendered futile, and sometimes even injurious.

The constituent parts of the fruits used in the experiments now under consideration, are malic acid, either in a state of purity, or one of combination with potash (a circumstance not yet perfectly ascertained); vegetable mucilage, or extractive matter; supertartrite of potash; sugar; water; the sweet principle; the colouring principle; tannin; super-oxalate of potash; and the principle of flavour. The proportions of these vary much in different

different fruits, and it sometimes happens that one or more of them is entirely absent. In the white currant, for instance, the colouring substance is often deficient, whilst it abounds in the elder-berry and red grape. So the super-oxalat of potash is rarely found; and on the contrary, those salts to which the tartarous, or malic acid appertain, are more frequent. So likewise, the sugar is much less abundant than the sweet principle, which is indeed the general cause of the sweetness of the greater number of our fruits. The vegetable mucilage is, if any, the only principle whose presence is invariable; and this principle is one of the most essential in the fabrication of a vinous liquor, as we shall see hereafter. The main diversities of character, in the products of the various fruits, is owing to the varying proportions of the several ingredients which they contain. It is true, that difference of management may produce different effects; but no contrivance can give to the gooseberry the constituent elements of the grape, nor can any mode of procedure extract the flavour of champaigne from the juice of gooseberries, although many, who have not been much accustomed to the flavour of the foreign wine, have been deceived by that made from our humble fruit.

Among the principles enumerated, tartar, water, sugar, the sweet principle, and the vegetable extract or mucilage, are the most essential in the conversion of fruits into wine. Colour and flavour may be considered as adventitious; and the principles which yield them, are in no wise essential to the process of wine-making. The effect produced by the super-oxalate of potash is unknown, as it has not been the subject of experiment.

Tartar, however, seems essential to the formation of a genuine vinous liquor; and an addition of it, where it is naturally wanting, is found, not only to ameliorate the

produce,

produce, but even to increase the quantity of alcohol, which a given proportion of sugar and the vegetable extract is capable of producing. Fermentation is more easily induced where this salt is present; and the experiments of some of the French chemists, seem to shew that it is decomposed during this process. Their opinion, that it is converted into the malic acid is questionable. The presence of tartar is the circumstance which most strongly distinguishes the grape from all the fruits which have been applied to the making of wine. In this fruit, it exists in the greatest quantity before ripening, and a portion of it disappears during this process. From this peculiarity of the grape, the practice has been introduced of mixing tartar with those washes, which makers of *sweets* intend for the basis of their wines; and from it I have also derived the practice of mixing tartar with those native fruits which are deficient in this substance; a practice which has been attended with the best results. The details of this practice will be treated of hereafter in their proper place.

The effect of the *malic acid*, another of the enumerated ingredients in fruits, is very different from that of tartar, inasmuch as it has been found injurious to the fabrication of wine. It is remarked, that all wines which abound in malic acid are of a bad quality, although in many cases it has not been determined, whether this acid was an original ingredient in the fruit, or whether it was not generated during the process of fermentation.

In either case, since its existence in wine is found to be injurious, it is important to attend to this fact, as our native fruits seem all to be characterized by an excess of malic acid. This is perhaps one of the most fundamental and least corrigible defects in our domestic wines. To

render the nature of this defect more obvious, it must be remarked, that the essential distinction between cider and wine, consists in the quantity of malic acid which enters into the composition of the former. From this cause our native wines are more apt to partake of the nature of cider than wine, although these are often rather disguised than changed by the predominance of undecomposed sugar, of brandy, and other foreign matters which enter into their composition.

It is a question, worthy of consideration, whether some chemical means might not be adopted for destroying a portion of this acid, either before or after the process of fermentation. In the manufacture of sherry wine, lime is added to the grapes before this process is commenced. However empirical this practice may be among the manufacturers, it probably acts by neutralizing this acid, as well as a portion of the tartarous acid, and to this is probably owing the peculiarly dry quality of that wine. A hint may probably be borrowed from this practice towards the amelioration of our domestic wines; and I may here venture to point it out as a practice worthy of imitation,—worthy at least of a careful trial. It is only from the results of such, and similar experiments, that we can hope ever to place our domestic manufacture on a sound and rational basis.

Of all the substances which are called into action, during the process of wine-making, sugar must be considered the most essential, being that on which the strength of the wine depends. Those fruits which contain the greatest proportion of sugar, furnish the strongest wine; the alcohol generated in the act of fermentation, being always found to bear a proportion to the pre-existing sugar. The principal defect in our domestic fruits is the small proportion of sugar which they contain;

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but it is at the same time that which we are most easily able to remedy; and it is on this basis indeed that the whole system of our domestic wine manufacture is founded. But even in this part of the process, difficulties occur, and lead to the imperfect fermentation of these wines, and the consequent sweetness by which they are too often characterized. The saccharine matter has indeed been considered as existing in two distinct states in vegetables, that of pure sugar, and that of the sweet principle; but it is perhaps more correct to consider sugar as an artificial substance formed by chemistry from the sweet principle, the only state in which sugar truly exists in vegetables. The sweet principle is characterized by its want of tendency to crystallize, and by the facility with which, on the addition of water, it runs into fermentation. Sugar, on the contrary, is crystallizable, and has no tendency to ferment, except in as far as it contains a portion of the sweet principle, or of that peculiar substance by which this principle is distinguished from sugar. If a solution of pure sugar in water be allowed to repose, it crystallizes without fermenting; nor does even the residuary syrup, or mother water as it may be called, undergo this process. But if it has been imperfectly refined, the remaining syrup will, after the deposition of the crystals, contain so large a proportion of the sweet principle, that it will readily run into fermentation; an accident well known to confectioners. The juice of the sugar-cane readily allows of the separation of the sugar from the sweet principle, and has hence become the almost exclusive subject of this manufacture. The residuary matter, known by the name of molasses, is the sweet principle of the French chemists, and is a peculiar compound of sugar, with vegetable extractive matter, similar to that which exists in the generality of

H 2 sweet

sweet fruits. In considering this substance, therefore, it will be most consistent with the accuracy of chemical language, to speak of it as a peculiar compound of sugar and vegetable matter, and not to consider it, with Deyeux, Proust, and Seguin, as a simple substance. Hence we should not say with these chemists, that in some fruits, and in some varieties of the grape, sugar predominates, and in others, the sweet principle; but that the sugar of the fruit is in some cases combined with more, and in others with less of the vegetable extract. These varying proportions of the two substances under consideration, are the cause of the various effects, which are observed in the results of fermentation in different fruits. If the sugar predominates, the wine will be sweet, unless expedients are used to complete the fermentation of the sugar, and convert the whole into wine. If the sweet principle is most abundant, or to speak more correctly, if there is much vegetable extract combined with the sugar, the fermentation will be complete, and the wine dry, unless artificial means, hereafter to be described, are used to prevent this effect. The distinction which I have here drawn, though appearing to partake of unnecessary refinement, will be found to lead to practical utility.

Among the enumerated ingredients of fruits, the *vegetable extract* naturally falls next under consideration. Although this substance has not been analyzed, we know that it differs from mere vegetable mucilage, by containing azote, or a substance which on decomposition produces it, since azotic gas has been detected in the produce of fermentation, both in an uncombined state, and in one of its most frequent combinations, forming ammonia. These substances are known to exist in yeast, which is a modification of the vegetable extract. In many

many vegetables, and conspicuously in the gluten of wheat, it exists in great proportion. It is for this reason that wheat as well as rye, act powerfully as ferments. It is also found in many flowers, in that of elder for example—in the leaves of the vine — in the grape — in the gooseberry, and in many other fruits as well as leaves. It is observed to abound in those vegetable juices which gelatinise on boiling. This substance, then, is the true natural leaven of fruits, or that by which the sugar which they contain, is rendered capable of undergoing fermentation: And in the artificial process of vinification, which is the subject of this paper, it is to this substance that we must look for the conversion into wine of that sugar which may enter into the compound. But I shall have occasion to enlarge on this subject, when I consider the process of fermentation.

Water, enumerated among the principles of fruits, simple as it may appear, is a substance requiring consideration. If the proportion of water be too small in the liquor subjected to fermentation, that process is difficultly either established or maintained. This is a matter of constant occurrence in those countries, when the juice of the grape is boiled to a certain consistence, or when the fruit before pressing, is allowed to undergo a partial desiccation. From these practices, result sweet and half-fermented wines, those of Cyprus and other places, as well as that class of wines known in Italy by the name of *Vino cotto*. The *vina cotca* of the antients, appear to have been of a similar quality from the same cause. The wines of Tokay and San Lucar, are known to derive additional richness and strength, from a moderate use of this practice. This process can be of no use in the manufacture of our domestic wines, nor does the nature of our fruits admit of it. An excessive addition

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of sugar may produce a similar effect: but I know not that any of the receipts in use approximate to that excess. That sweetness, which is the prevalent fault of our wines, arises from other causes, which I shall consider hereafter.

The fruits of this country possess so little of the three remaining substances, which were enumerated as constituents, that it is unnecessary to dwell much on them.

Scarcely any *colour* is contained in our fruits, if we except the black cherry and the elder berry, and as colour may be considered in the light of an ornament, and is easily procured by colouring ingredients, its want is not to be regretted; the essential parts of wine-making in nowise depend on it.

The *tanning principle,* which is the cause of astringency, is contained in the husks and stems of some grapes, and communicates at the pleasure of the operator, that roughness known in Port wines. The sloe, and damson possess it, but as it can readily be communicated by kino or catechu, and is not a very desirable quality, it is sufficient to have noticed it, considering, as we may, the imitation of foreign wines by circuitous means, as a fruitless attempt.

The last principle, that of *flavour,* is so uncertain and fugacious, that it is difficult to establish any general rules. In many grapes, as those of Frontignan, the flavour of the fruit is absolutely identified with the wine which they yield; but in all such cases the wine is sweet and half fermented. The finer flavours of the superior wines, those of claret, hermitage, and burgundy, bear no resemblance to that of the fruit, but are the result of the vinous process. In the manufacture of many wines, recourse is had to flavouring ingredients, such as orris-root, grape-flowers, almonds, mignonette—a process which

which is imitated in this country in the making of elder and cowslip wines. If the flavour of fruits could be transmitted with certainty to the wines, we might expect similar results from the strawberry and raspberry; but the effect of fermentation is generally such as to volatilize or destroy this delicate principle. Hereafter I shall point out a probable method of attaining this object.

If a knowledge of the circumstances which attend and modify the intricate process of *fermentation*, be necessary in the making of wine from the grape, it is still more requisite to investigate the various accidents and causes which may affect it, when the substances exposed to its action, are, like those used in our domestic manufacture, artificially compounded. It is thus only that we can hope to establish such general rules, as may be applicable to those ever-varying cases, where particular rules of practice would be unattainable. A general notion has already been given of the substances, to whose mixture the process of fermentation is owing, and the essential ones will be found to consist of sugar, vegetable extract, tartarous and malic acid, and water. These are indispensable, and to their varieties in proportion, some of the most remarkable differences in the results of fermentation will be found owing. Among these, sugar is the most essential, since the alcohol of wine is more particularly derived from the decomposition of this substance. The strength of the wine is proportioned to the quantity of sugar fermented, and the most saccharine juices, therefore, afford the strongest wine, or in the artificial process, if so it may be termed, that compound to which the greatest proportion of sugar has been added, will be capable of giving the strongest, if duly managed. But we have already seen, that sugar and water alone do not ferment, if the sugar be pure, and that this process

only

only takes place in clayed sugars, or in those which contain a portion of that vegetable extract which characterizes the sweet principle. In the juices of fruits, the sugar and extract exist in a state of combination, to which, as I before remarked, the term of Sweet Principle has been applied. If the juice of the grape, for example, be exposed to heat and rest, a coagulable substance is separated. The juice then ceases to ferment with the same facility, but may again be induced to undergo that change, by a re-addition of a matter similar to that which was separated from it. This matter is found in all vegetables, in some, as in wheat, conspicuously; and it appears to constitute the greater proportion of yeast, as well as of the lees of wine and beer, or other fermented fluids. Here, then, we have the theory of this process, as it is applied to artificial compounds. It consists of mixing with a solution of pure sugar in water, a certain proportion of this unknown substance, which, to distinguish it from common yeast, I shall hereafter call by the name of leaven. It is on the proportion, quality, and management of the leaven, that the most important consequences in vinification depend. I must therefore describe at more length, the various modes under which it appears.

The natural leaven of fruit, is coagulable, and partially separable by heat, but it is not entirely rendered inert. From this cause, as well as from the partial dissipation of the water and concentration of the sugar, boiled juices produce a sweet wine, the process of fermentation being rendered incomplete by a partial separation of the leaven. When the process of fermentation is suffered to proceed in any of the natural compounds formed in the grape or other fruits, a portion of the leaven is separated from the wine, and is exhibited in two forms of yeast and lee,

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part rising to the surface in froth, and the remainder subsiding to the bottom of the vessel. It is essential to attend to this distinction, and to understand the true nature of these substances, as some of the most important practices in wine-making depend on it. I must add, that it still remains uncertain, whether any portion of the leaven enters into combination with the vinous produce, or whether it acts solely by exciting the requisite changes in the sugar, and is then finally and entirely separated. The yeast and lee form the artificial leaven, which, in some important particulars, differs from the natural. It is soluble in hot water, whereas the natural is not. But it is insoluble in cold, and it is thus separated by the act of fermentation. I may add, that, notwithstanding the numerous experiments to which yeast has been subjected, its composition, like that of many other vegetable matters, remains obscure. It is important, however, to recollect, that it contains ammonia, or at least the principles of this substance, as Proust has shown. Those who have been engaged in the manufacture of domestic wines, must know, that one of the most frequent defects of these wines, is an ammoniacal taste; and there is little reason to doubt, that it arises from some mismanagement in the process of fermentation, or an improper introduction of artificial leaven. Although I cannot point out a precise remedy for this evil, these remarks may perhaps turn the attention of wine-makers to search for one.

It will from these considerations be evident, that if certain proportions of sugar and of leaven, whether natural or artificial, be taken, and the process of fermentation be suffered to proceed to its natural termination, the result will be a fluid perfectly vinous, containing neither sugar nor acid, and analogous either to beer or to wine,

 according

according to other circumstances hereafter to be considered. If the proportion of leaven be deficient, the produce will contain unchanged sugar; and the same effect will take place, if the fermentation be prematurely stopped by artificial means. If, on the contrary, the leaven is in excess, or the fermentation has been designedly protracted by artificial means, a new product will be formed, and the whole, or a portion of the alcohol, will disappear, and acetic acid will be found in its place. Sweet wine, therefore, is an imperfect wine, or one in which the leaven has borne so small a proportion to the sugar, as to have been incapable of converting the whole into a vinous liquor. This is the case with our domestic wines, when a large quantity of sugar is added to so small a proportion of fruit, that the compound does not contain natural leaven enough to convert the whole into wine. This evil may be corrected by the use of the artificial leaven yeast, but the quantity added is generally inadequate to this object. It is from this cause, that the makers of domestic wines so often attempt in vain to produce dry ones. When this is attempted by diminishing the sugar, the result is a liquor both feeble as a wine, and at the same time, tending strongly to the acetous fermentation. If, on the contrary, recourse is had to an increase of the yeast, the consequence is an increase of the bad flavour, which this substance almost invariably communicates. The true remedy is, so to balance the vegetable juice and the sugar, as to produce a fluid analogous to the juice of the grape; or one in which there shall be a proportion of natural leaven, sufficient to convert the whole of the sugar into wine. Where a sweet wine is desired, this caution is not necessary. I shall hereafter shew how wines even of this quality can be procured from such a fluid, by an artificial

artificial suspension of the fermentation. I cannot too strongly caution the artist against the use of the common and pernicious practice of exciting the fermentation, by the yeast of beer. I have already made it appear, that when a due proportion exists between the leaven and sugar, either in a natural or artificial fluid, a regular fermentation takes place, and a perfect conversion of the whole into wine. It is therefore unnecessary to add yeast to a fluid properly compounded; and it is further injurious, since the use of this substance not only communicates the bitter flavour which it derives from the hop, but a peculiar and nauseous taste, apparently derived from its ammoniacal quality. It is well known to brewers, that a single spoonful of putrid yeast, will spread its contagion through many tuns of beer. If an artificial yeast is ever wanted, it may be found in the lees of wine, in which it is mixed with tartar, or else it may be reserved from the fermentation of former parcels of domestic wines. But a proper management of the fermentation itself may be made to supply the want of natural leaven. I have already shown, that this leaven is rendered insoluble by the act of fermentation, and that it partly rises to the surface, and partly falls to the bottom of the fermenting fluid. By restoring this separated matter, the process may be protracted at pleasure, till the wine has acquired the degree of dryness that may be desired. It is only necessary for this purpose to break the head, and disperse it through the fermenting fluid, or to agitate the whole in such a way, as to mix the lee and scum with it, until the desired effect is produced. The apparently obscure process of rolling wine, or of returning it on the lees to feed, as it is technically called, is founded on this principle; it renders the wine stronger and better, by re-exciting the languid fermentation.

The converse of this practice will be equally intelligible. If a sweet wine is desired, the fermenting process may be at any time artificially suspended, by separating the wine already produced from the ferment with which it is mixed. The operations in use for this end, consist in decanting, in clarifying by means of glue or albumen, or in the use of certain chemical substances which decompose the leaven; processes which I must consider more at length hereafter. From this view, it will be easily deduced, that sweet wines cannot turn sour because their leaven has been expended. Another remark of equal importance may also be deduced, that all wines will have this tendency, if the whole of the sugar of the fluid has been converted, and if at the same time care has not been taken to separate completely the leaven which may remain in them. Hence the necessity of fining wines for their preservation, as well as their beauty. It will also be apparent, that if any fluid to be fermented, is of such quality, that the leaven predominates over the sugar, it will be necessary to stop the process by chemical means, to prevent the occurrence of the acetous stage, which would otherwise take place.

I have already stated, that both the malic and tartarous acids take a share in the process of fermentation. Where the former naturally predominates, as in apples and pears, the produce is cider or perry; where it abounds in the juice of the grape, it is supposed to lead to bad qualities in the wine. The practice of liming wine vats, and that in use with sherry wines, seem to have been founded on some views of this nature.

It appears from the experiments of the Marquis de Bouillon, that tartar contributes to the formation of alcohol, and that it is partially decomposed during this process, a portion of it being converted into malic

 acid.

acid. But even sugar and tartar require the presence of vegetable extract before they can be induced to ferment, although the addition of tartar materially increases the facility with which a compound of sugar and extract only is brought into fermentation. Hence we are enabled to explain the reason why moderately acid grapes run much more readily into fermentation than sweet ones.

From this view of the presence of tartar in the grape, and its utility, we may now deduce rules applicable to the art of domestic wine-making.

The juices of our fruits are known to be deficient in saccharine matter, and experience has long established the well-known remedy,—that mixture of common sugar on which the whole art depends. But it has not generally entered into the views of makers of wine to supply this other important defect, although the means are equally easy. The makers of *sweets* are indeed acquainted with it, although, from the defective nature of their processes in general, it has not produced in their hands the effects which might have been expected. Their principal error consists in the use of yeast and molasses,—articles, whose vicious nature is incorrigible; but in the experiments which I have directed to be made on this subject, ample reason has appeared to consider the addition of tartar to the juices of our fruits, as a valuable improvement in the art of making domestic wines. In the use of this ingredient no very accurate limit seems necessary, since the wine of the grape may generally be considered as a saturated solution of tartar; and I may add, that by using crude tartar instead of the purified salt, we derive other advantages from the leaven contained in the lees attached to it.

From the preceding remarks, we shall be at no loss in understanding the true theory of this art. The formation

of

of a liquor truly vinous is the first object, and the adventitious circumstances of colour and flavour will be considered hereafter. It is almost superfluous to say, that the wine of the grape is superior to every other vinous liquor, and we have in the foregoing remarks a detail of the circumstances on which the formation of wine from that fruit depends. These are, sugar, the extractive matter, and tartar. If now we compare our common fruits with the grape, we shall find, that, in common with it, they possess the extractive matter or natural leaven, but that they are deficient both in sugar and in tartar. Our first object, therefore, should be to assimilate them as nearly as possible to the grape, by the addition of the requisite proportions of those two substances. The whole process is, therefore, from its commencement artificial, and capable of considerable precision. It is only required so to proportion the adventitious ingredients to the natural juice, as to form a fluid resembling the juice of the grape. To the peculiarities of the several fruits employed, we must afterwards look, for the flavour or other accidental properties which they may be capable of giving. It is necessary also to consider, that as the several fruits may differ in their quantity of leaven, as well as in their proportion of sugar and acid, some attention to their various compositions will be required before any accurate rules of practice can be established.

TO BE CONTINUED IN OUR NEXT.

List

List of Patents for Inventions, &c.

(Continued from Vol. XXX. Page 384.)

ANTONIO JOAQUIN FRIERE MARROCE, of Broad-street-buildings, London, Merchant; for a method of making or manufacturing an improved machine or instrument for calculating and ascertaining the longitude at sea. Communicated to him by LUIS COCTANE ALVINA DE CAMPOS, residing abroad. Dated April 29, 1817.

WILLIAM COLLINS, of Maize Hill, Greenwich, Kent, Esquire; for an improvement or improvements in the composition and preparation of a metal for the manufacturing thereof into sheets or plates, and the application, when so prepared and manufactured, to the preservation of ships, by sheating or covering the bottoms therewith; and an improvement or improvements of the chain-pumps used on-board ships. Dated May 6, 1817.

HENRY WILMS, of Union-street Lambeth, Surrey, Cabinet-maker; for an artificial leg, arm, and hand, on an improved construction. Dated May 8, 1817.

JAMES GERARD COLBERT, of Winsley-street, in the parish of St. Mary-le-Bone, Middlesex, Mechanical Watch-maker; for certain improvements in the method or methods of making screws of iron, brass, steel, or other metals, for the use of all kinds of wood-work. Communicated to him by a foreigner residing abroad. Dated May 13, 1817.

RICHARD WILLIAMS the Elder, of Fursley, Gloucestershire, Card-maker; for certain improvements in the manufacturing of cards for dressing woollen cloths. Dated May 13, 1817.

JOHN

John Walker, 12, Great Charles-street, Blackfriars Road, Christ Church, Surrey, Millwright; for an improved method of separating or extracting the molasses or treacle from and out of Muscovado, brown, or new sugar. Dated May 13, 1817.

Archibald Thomson, of Church-street, Christ Church, Surrey, Machinist and Engineer; for a machine for cutting corks. Dated May 17, 1817.

Robert Salmon, of Woburn, Bedfordshire, Gentleman; for an apparatus for the more useful, safe, pleasant, and economic, use of candles; and also improvements in the apparatus now in use for part of the same ends. Dated May 17, 1817.

William Bound, of Ray-street, Clerkenwell, Middlesex, Ironfounder, and William Stone, of Berkly-street, in the same parish and county, Brass-founder; for a method of applying certain apparatus for converting the fuel, and for heating retorts, of gas-lights apparatus, into coke or charcoal. Dated May 17, 1817.

Benjamin Cook, of Birmingham, Warwickshire, Gilt Toy-maker; for an improved method of making and constructing rollers and cylinders both solid and hollow, which will be found useful in various manufactories in this kingdom. Dated May 17, 1817.

William Owen, of Wrexham, Denbighshire, Cabinet-maker; for a portable table or box mangle, upon a new or improved principle, for getting up and smoothing of linen, cotton, and other articles and things. Dated May 17, 1817.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLXXXII. SECOND SERIES. July 1817.

Specification of the Patent granted to Colonel Sir William Congreve, *Baronet, of Parliament-street, in the City of Westminster, and County of Middlesex; for a new Mode of manufacturing Gunpowder.*

Dated July 3, 1815.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said Sir William Congreve do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described as follows; that is to say: In the first place, as the due mixture of the ingredients of gunpowder, namely, saltpetre, sulphur, and charcoal, is of the utmost importance in producing the strength of the compound, and as at present little pains are taken in the first mixture before the composition is placed under the runners, I have invented a machine for this purpose, to bring the operation to as great perfection and certainty as possible in the first instance.

This machine is thus constructed: Three hoppers, for the three ingredients, are fixed in a frame close together, in a horizontal line, and a cylindrical brush, either of hair, wire, or any other suitable material, about three inches in diameter and six or eight inches long, is then fitted on an axis into an oblong aperture, of the same dimensions, in the bottom of each hopper. On the cylindrical brush the composition in the hopper rests, so that when the brush is made to revolve on its axis, the composition will be drawn out in a fine stream, of the same breadth as the brush, and on the same principle as cotton thread is drawn by the revolutions of the rollers in the cotton mill, the quantity of the stream being adjusted by the closeness with which the cylinder is fitted to the aperture of the hopper. With this arrangement it follows, therefore, that the quantity of composition drawn out in a given time depends upon the number of revolutions made by the roller in that time, and consequently any required proportions of the different ingredients may be drawn from each different hopper, according to the proportionate velocities with which the brush rollers are made to revolve; and these being regulated according to the due proportions required for gunpowder, and their motions being sustained by any mechanical action, we have thus the means of keeping up streams of the three ingredients, having the proportionate quantity of each exactly what is required: this, therefore, is the first part of the process.

Again, beneath these hoppers and rollers, on the same frame, a broad endless band, of leather, canvas, or any other suitable material, is fixed on rollers, so as to have a continued horizontal motion, sustained by the same action as supports the motion of the discharging rollers of the hopper; and on this band, so in motion, are received the

the three proportionate streams of composition above described as issuing from the three hoppers. In proportion, therefore, as the velocity of this band's motion is increased with respect to the velocity of the issuing streams, so will these streams be reduced in thickness drawn out by this second process, and carried away upon the band in lamina, thinner, and more attenuated than as they issue from the hoppers. It follows, therefore, as the band passes with the same velocity under each of the hoppers, that it will be covered with a stratum of composition, composed of the three ingredients, uniting upon the band in the due required proportions, and attenuated by a sufficient velocity in the band, so as to bring the falling particles of each ingredient into a due and almost mathematical juxtaposition with those of the other two, and in the predetermined proportions, regulated by the velocity of the extracting rollers. It is almost needless to add, that the combination of particles thus collected is detached from the band, where it turns over the end roller, and is there gathered into a single receiver. In this way every mill-charge may be mixed separately, or in greater quantities, according to the size of the apparatus; and although the mixture thus obtained may be considered as nearly perfect, still, as a few small lumps will some times escape the revolving brushes, I have considered it adviseable to pass the composition from this receiver through another machine, for the purpose of breaking down any such irregularities, and for the more complete incorporation of the ingredients. This second machine is somethat similar, but consists of a single hopper only, having a large cylindrical brush at the bottom of it, the lower part of which acts against a fine wire sieve, embracing half the brush. By this means the contents of the hopper, consisting of the compound of in-

 gredients,

gredients, united as above described, are forcibly driven through the sieve, and reduced to the finest powder, so as, by a few repetitions of the process, completely to remove any imperfections that may remain after the first mixture. The repetition of this operation, to any desired extent, in one continued process, I have effected by letting the contents of the hopper fall into the inside of a vertical drum, fitted with ledges, this drum working round the hopper, so that when revolving it carries the composition received from the hopper at the bottom round to the top, and drops it back into the hopper again, from the ledges, as fast as it issues, and for as long a time, or as frequent repetitions of its passing through the hopper brush and sieve, as may be wished, by keeping the machine at work. Such, therefore, is the process of mixing, which I adopt previously to working the powder under the runners; and as the great end of the working under the runners is the due mixture and incorporation of the ingredients, it follows, that much of this operation, which, from the present imperfect mode of previous mixture, is tedious, laborious, expensive, and dangerous, may be saved, by the simple, secure, and easy previous admixture here provided for. Indeed, it is difficult to say with the present experience, to what extent the latter of these operations may not ultimately be substituted for the former.

We now proceed to the press-house, where, instead of the present mode of throwing the mill-cake under the press as it comes from the mill, by which means large intervals are left in the mass, so as to form a very soft and brittle cake in the parts near those intervals, the mill-cake is first broken down, by passing it through brass rollers, with coarse teeth, by which it is brought into such a state, that it can be distributed so regularly in the

press

press as cannot fail to produce an equal and thoroughly well-pressed cake; instead also of being laid between a few copper plates, as at present, so as to turn out from under the press in cakes of two and a half or three inches in thickness, it is laid with much nicety between an increased number of plates, at gauged distances, so as to turn out in cakes, the average thickness of which does not much exceed one-eighth of an inch. It is needless to say, that a much more regular and uniformly pressed cake is thus produced. But the object of this arrangement does not rest here: it anticipates an entire new mode of granulating the powder, by which not only the danger of the corning-house is obviated, but many other imperfections attaching to the present system of granulation avoided. The new granulating machine, therefore, for which the pressed cake is thus prepared is formed as follows. It consists of three parts, which are placed in three distinct rooms, one principal and two adjoining rooms, having a strong brick wall between them, to act as a traverse to each. In the principal or middle room of the three the actual granulating apparatus is placed. In the first of the adjoining rooms is contained a large hopper, in which the pressed cake is brought and deposited, half or at most a whole barrel at a time, to supply the machine in the second or middle room, while the third room contains a bin, into which the powder passes as fast as it is granulated in the second, and is thence carried away at stated periods to a store magazine, to prevent any accumulation.

The general arrangement being thus explained, it is now necessary to describe the different parts of the machine. The granulating machine itself, in the middle room, consists of sets or pairs of brass rollers, about two feet six inches in length, and two inches, more or less, in

in diameter, supported in the middle, and divided into teeth, as will hereafter be more particularly described, each pair working together, by means of a pinion or nut, at the end of each roller, so that they draw inwards, like the rollers of a flatting mill, or those of a cotton mill. The teeth of these rollers are of different degrees of fineness, and they are set at different distances, the coarsest so far apart as readily to draw in the thin pressed cake above described. Now these pairs of rollers are set in a strong frame of cast iron or wood, about six feet high and eight or ten feet long, more or less, so that the upper and coarser pair are at the top of the frame about eighteen inches, or two feet higher than the other pair. They are then connected together by a double crank, or a rod and pinion, or any other way, so that when one pair is set in motion by the principal mover of the machine, whatever it may be, water or horse, or any other power, the other pair will also move; and they are moreover so arranged, whether in a direct position over one another or obliquely placed, that whatever passes through the upper or coarser pair shall pass also through the finer or lower pair. Now the teeth of the coarser pair of rollers are so constructed, that the thin press cake, being brought gradually into a hopper, surmounting those rollers, is immediately drawn through them, and broken into irregular fragments or heads; which fragments again passing through the lower or finer rollers, are finally and at once reduced into the most perfect grains of every different size required, which are separated in one operation, by falling from the lower pair of rollers upon a series of wire sieves, calculated according to the different sized grains required. These sieves being of a sufficient length, from four to six feet, more or less, are placed obliquely, and kept in motion by the common mover, so that

that the different grains pass from top to bottom of the sieves in the act of separation, which at the same time cleans the powder from the dust. Now these different sorts of powder and their dust having thus been separated and carried to the bottom of the sieves by their motion and obliquity, are from each respective sieve delivered into flat funnels, which dispose of each sort upon a horizontal endless band of canvas, or other material, running from the foot of the granulating machine in a flat trunk, through the traverse wall, into the bin above mentioned, as being provided in one of the adjoining rooms for receiving the powder when granulated, there being as many bands and as many compartments in the bin as sorts of powder, including the dust; and these bands being kept in constant motion by the first mover, so as to carry off every grain of powder and dust as fast as it is formed, and thereby prevent any accumulation about the machine in the act of granulation.

It remains now only to describe how the machine is fed with the cake, that also being done by a mechanical process, to prevent the necessity of any person being near the machine when actually at work. This is in fact, performed by nearly the same operation as that by which the powder is carried off after it is grained, that is to say, by bands of canvas, or any other material, passing from the hopper into the outer room, through the traverse wall, into the hopper, over the upper set of granulating rollers in the middle room. These bands, however, are stronger, more tightly strained, and have cross straps, of leather or cords, or small rods, sewed flat, or otherwise attached upon them, every nine or ten inches, to raise the cake out of the hoppers, the back of which being placed at an angle of forty-five degrees of inclination, and the band moving up that back, the cake, although thrown

thrown indiscriminately into the hopper is nevertheless drawn out of it in single pieces, the surplus not actually raised, and supported by the cross straps on the band falling or sliding back, from the great inclination at which the strap moves in its progress up the back of the hopper. Having surmounted which, however, with its due load, namely, covered with a single layer of cake, it takes a horizontal course through the traverse wall until it reaches the edge of the hopper of the granulating machine, and there falls in regular quantities between the upper set of rollers for granulation, as already specified. It is almost needless to say, that these feeding bands are also kept in a constant uniform action by the common moving power; and I believe the only remaining details of the machine necessary to be described is the form of the teeth of the rollers. They are of various sorts, either grooved horizontally, so as to bring the teeth to sharp edges, or in spiral grooves, and either cross cut or not, into rings, leaving void spaces between them, equal in breadth to the rings of teeth themselves, and so arranged on the reciprocal rollers, that the rings of teeth on the one roller shall work into the void spaces of the other, and *vice versâ*, but no part of the rollers or teeth actually touching in any case: thus arranged, the teeth never clog. Here also it must be stated, that the teeth of the large rollers in the press-house for breaking down and preparing the mill cake are formed on similar principles to those of the granulating roller, only coarser in proportion as the mill cake is thicker than the press cake.

The advantages of this granulating machine are numerous. In the first place, the whole operation being, as above described, performed by mechanical means, requiring no person to be present in either of the rooms except at the moment of discharging the powder from

the bin, and of replacing the cake in the hopper, which is performed at the same time, during which the machine is stopped. And, moreover, as no accumulation can take place in any part, it follows that there is no personal danger to any one, neither can any serious mischief happen to the machine itself, with the traverse walls, if the quantity of cake put in at each charge be limited, as above stated, to a barrel at a time. The small quantity which can ever exist in the principal room protects the machine itself, while the adjoining buildings being of a slight and temporary nature, an explosion with the quantity limited would be of little consequence, no person being, as before stated, required in the building when the work is going on.

The next great advantage of this machine is the extraordinary quantity of work of which it is capable with a very moderate power. From the very nature of the machine working so much by mechanical means, it is evident that very few persons are required to attend it. And when it is stated, that a machine of the dimensions above mentioned has been found capable of making upwards of six barrels of powder in an hour, the saving of labour and power, and its consequent economy, must be self-evident to all persons at all conversant with the present mode of corning. But the economy does not rest here: the proportion of dust to grain made in this machine is not much above one-thirtieth, whereas in the common mode it is full one-half; so that, independent of the quantity of material absolutely lost in the old mode in dust, such is the great proportion of dust to grain produced, that on an average every barrel of powder manufactured may be said to be pressed twice over, besides which, a considerable portion of this dust is obliged to be reworked under the runners, whereas it is evident, that

 the

the small quantity of dust produced in the machine is hardly worthy of a consideration as to the pressing, and can leave none to be re-worked under the runners.

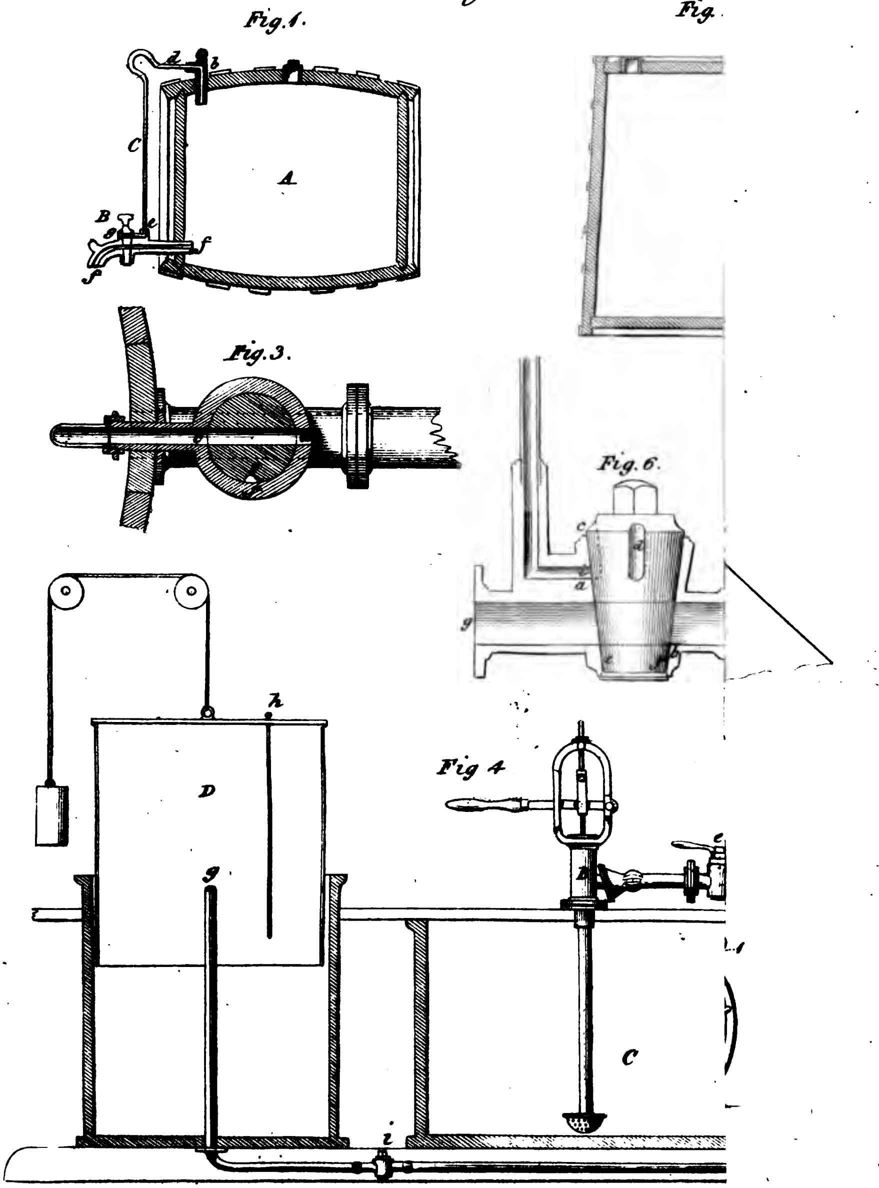
But there are other advantages not to be passed over. In the first place, the grain is more uniform and more dense, from being made out of the thin cake. In the next place, it contains a more smooth and less broken surface, from the same cause, and is, therefore, on both these accounts, less liable to wear into dust. In addition to which, the grain must be cleaner and more free from foreign matter; a considerable quantity of which is collected, by friction, from the soft substances of the parchment sieves, &c. as well as gathered up with the dust; all of which is evidently avoided by the construction, materials, and mode of operation of this machine.

It remains now only to be stated, that as the preservation of gunpowder from the moisture of the atmosphere is as important to its strength as the due mixture and incorporation of its ingredients, or any other process attaching to it, after having stoved and dusted it, I enclose it in wooden barrels, lined with thin metallic linings, either of copper or lead, or pewter, or any other sufficient substance, so as to form one entire barrel of the exterior and lining, and having an aperture at one end, so constructed that the enclosure may be made perfect by a luting of bees-wax and tallow, or a mixture of rosin and tallow, or any other sufficient luting; this aperture and luting being further secured, by a false head, to the wooden barrel, so that the powder is thus enclosed in a case perfectly air and water tight, the interior of which is completely supported and protected by the exterior from being bruised or otherwise injured. And this mode I have found to be much less expensive than any system of barrel made wholly of metal, without an exterior of

wood,

Pl. III. Vol. XXXI. S.3

Mr. Russell's Paten



wood, on account of the difference of the quantity and nature of the metallic substances required, while the slight lining, as a preservation, is equally efficient as the most expensive metallic case alone can be. For the greater convenience of stowage, in particular situations I have substituted rectangular cases, lined with different materials, on the same principle as the barrels.

In conclusion, I have but to observe, that the different sorts of machines here specified may be applicable in a variety of other processes, as well as those above specified; and that, whatever these processes may be, the operations and actions of the machines themselves must still be the same as those specified for this patent.

In witness whereof, &c.

Specification of the Patent granted to WILLIAM MADELEY, *of the Parish of Yardley, in the County of Worcester, Farmer; for an improved Drilling Machine for drilling Beans, Turnips, Peas, Pulse, Corn, and Seeds of every Description.* Dated July 27, 1815.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Madeley do declare that my said improvements in the making and construction of drilling machines, are described and ascertained in manner following, reference being had to the figures or drawings; that is to say: That instead of the usual method of drilling through holes or channels in the seed wheel, I have invented a taper kind of seed hole or cap in the same, that will admit but one seed, grain, or pulse at a time, which will deliver the same into the conductor, to depo-

sit the same at any given depth or distance that may be required; and as this peculiar sort of seed-hole is entirely an invention of my own, I am desirous of maintaining this my exclusive right and privilege.

Reference to the Drawings.

Fig. 1 (Plate III.) the machine. O, wood frame, with two beams and stilts. 1, iron bend and hoop, to draw machine. 2, front wheel and spindle. 3, large wheels and main spindle. 4, glands to screw frame to main spindle. 5, seed wheel socket and glands, as in Fig. 3, main spindle passing through them, to which they are screwed, and slide along to any distance required; a groove in the socket over where the seed passes to prevent it from crushing. 6, seed hopper, with brush screwed to iron standard inside hopper, and screwed firm upon the wheel, which keeps back all the seeds or grains except the one that the hole in seed wheel takes. 7, brush screwed under frame, to keep the seed wheel clear. 8. plough which lets in the seed. 9, conducting pipe, for the seed behind the plough.

This machine moves upon three wheels, made of cast iron, or any other proper material, which stand in a triangular form. To set it to work, if you cross the lands, begin at furrow, leaving one land to turn upon, bearing on stilts, to keep the weight on the two large wheels to turn, and lift up the stilts whilst the horse turns, which throws the weight on front wheel, and stops the seed. When turned drop the stilts, and bear on as before, keeping the wheels along the same mark it made when coming the other way. One frame may be made to answer for beans, peas, and all other grain, by shifting seed wheels; but turnip seeds, requiring brass wheels and sockets, or wheels

wheels or sockets of any other proper material, on a small scale and small spindle, must be a frame for that alone.

Fig. 2, No. 1, brush screwed to stand, and which keeps back all the seed or grains except the one in the hole the seed wheel takes. 2, main spindle. 3, seed wheel. 4, hole in seed wheel, for receiving a seed. 5, socket and glands. 6, beams. 7, brush screwed upon frame to keep seed wheel clear. 8, plough.

Fig. 3, seed wheel. 4, hole for receiving seeds. 9, hole through which spindle passes.

In witness whereof, &c.

Specification of the Patent granted to GEORGE FERGUSON *and* JOSEPH ASHTON, *of Carlisle, in the County of Cumberland, Hatters; for an improved light, elastic, water-proof Hat, commonly called Beaver Hat.*

Dated July 14, 1813.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, we the said George Ferguson and Joseph Ashton do hereby declare that the nature of our said invention, and in what manner the same is to be performed, are particularly described and ascertained as follows; that is to say: We dissolve 8 oz. of gum amber in 10 oz. of essence of turpentine, and 6 oz. prepared linseed oil, and 4 oz. essential oil of lavender; also 4 oz. of essence of turpentine, 4 oz. of gum mastic, 4 oz. of sandrack, 4 oz. of gum anima, 4 oz. of gum elima, all dissolved in 30 oz. of rectified spirits of wine. The whole of this solution well mixed together, and worked into the body and brim of the hat, will make it perfectly water-proof and elastic.

In witness whereof, &c.

Description

Description of the Design and Construction of the WATERLOO BRIDGE.

With a Plate.

THE project of constructing a Bridge over the Thames, between the bridges of Blackfriars and Westminster, it is believed originated with Mr. George Dodd about the year 1805. It happened, however, to this as to similar undertakings, that a considerable time elapsed between the first idea and the ultimate arrangements necessary for carrying it into execution; at length in the year 1806 subscriptions were received, and a Committee of Management was appointed and entrusted with the requisite powers, to enable them to obtain an Act of Parliament for that purpose.

The first Act was obtained in the month of June 1809, and incorporated the proprietors under the name of the "Strand Bridge Company," and empowered them to raise the sum of 500,000*l.* in transferable shares of 100*l.* each; and the further sum of 300,000*l.* by the issuing new shares, or by mortgage in case it should be found necessary.

In July 1813 a second Act was obtained by the Company, to enable them to purchase additional property for the purpose of enlarging and altering the roads and approaches, and to raise a further sum of 200,000*l.*

In July 1816 a third Act of Parliament was obtained, granting the Company additional powers to treat with certain persons not included in the above two mentioned Acts; and in this Bill a clause was introduced, changing the name of the Bridge from the "Strand Bridge" to the "Waterloo Bridge," which name it now bears.

Mr. Rennie was appointed engineer to the Company on the 23d day of June 1810, and was desired to furnish plans,

plans, estimates, &c., for the undertaking. Mr. Rennie furnished two designs, one of seven, and one of nine arches; the latter, of which the accompanying Plate (Plate IV.) is a correct representation, was finally approved by the Committee, and ordered to be put into execution.

It is situated about 60 feet West from Somerset-house on the North-shore, and about 90 feet West from the Waterman's-stairs at Cuper's-bridge on the South-shore, or nearly half way between the bridges of Blackfriars and Westminster.

The river there is 1326 feet wide at high-water. Ordinary spring tides rise about 13 feet, and ordinary neap tides about 9 feet 6 inches. The current sets principally on the northern shore. The greatest depth at low water is about 9 feet. The bed of the river is composed principally of a stratum of sand and gravel resting upon clay.

The bridge is level, and consists of nine equal semi-elliptical arches, of the span of 120 feet each, and a rise of 35 feet, thus leaving for the navigation 30 feet of clear height above high-water of spring-tides, and forming together an ample water-way of 1080 feet. The road-way being straight, for the distance of about 1380 feet, forms a most agreeable transit for passengers.

The abutments are 40 feet thick at the bases, and diminish to 30 feet at the springing of the arches; their lengths, including the stairs, are 140 feet. The piers are 30 feet broad at the base, and diminish to 20 feet at the springing of the arches; their lengths at the bases are 87 feet. The points, or saliant angles of the piers, are in the form of a gothic arch, and terminated above by two three-quarter columns supporting an entablature which forms a recess. The whole is surmounted with a ballustrade, and a friese and cornice of the Grecian Doric.

The

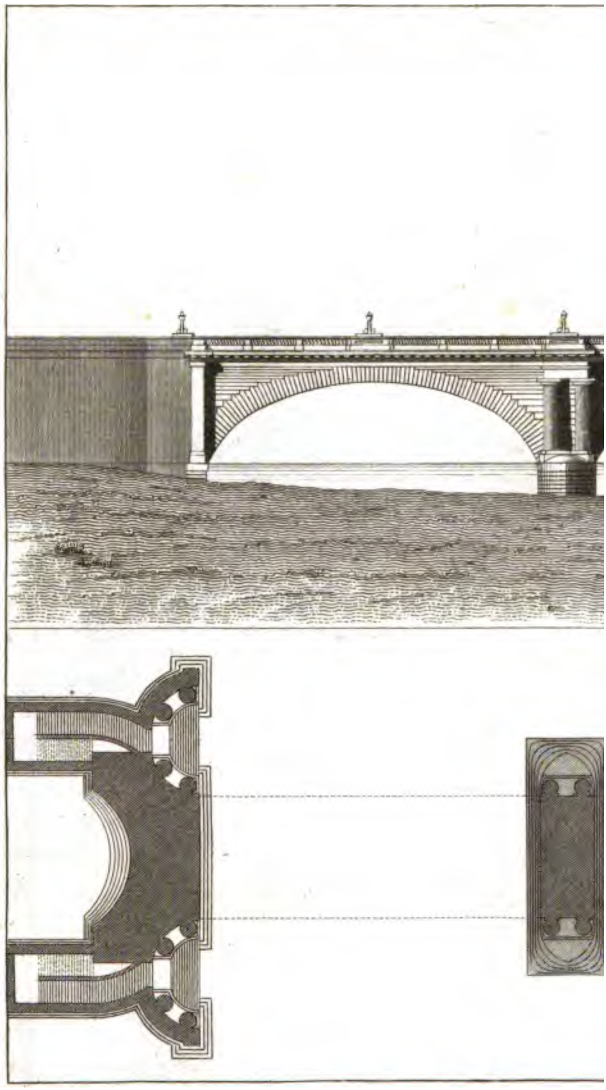
The columns are Doric also, and were selected on account of the extraordinary strength of their proportions, as being best suited to a structure of this magnitude; they are 23 feet 9 inches high, or rather more than four diameters.

There are four plying places or stairs for watermen; these are formed by circular wings projecting at right angles to the bridge, with archways leading to the roadway. These wings are ornamented with columns, entablatures, &c. the same as before described.

The bridge being level, and of such a great length, it was necessary to provide means for carrying off the rain-water; this is effected by having circular openings in the centre of each pier, which enter the river immediately below low-water mark; these openings are connected with iron branch pipes up to the level of the roadway, where gratings are placed to receive the water.

The clear width between the parapets is 42 feet 4 inches, allowing 28 feet 4 inches for the carriage-way, and 7 feet each for the footpaths.

The roads or approaches to each end of the bridge are 70 feet wide throughout, except just at the entrance into the Strand, and are carried over a series of semicircular brick arches of 16 feet span each. The Southern or Surrey approach is formed by thirty-nine of these, besides an elliptical arch of 26 feet span over the present Narrow-wall road, and a small embankment about 165 yards long, having an easy and gradual ascent of not more than one foot in thirty-four; when finished, it will continue in a direct line to the Obelisk, thus opening at once into the centre of communication with Kent, Surrey, Sussex, and the parts adjacent. The northern approach enters the Strand near Exeter Change, with a descent of not more than one foot four inches in the whole



John Rennie. Esq.r Engineer.

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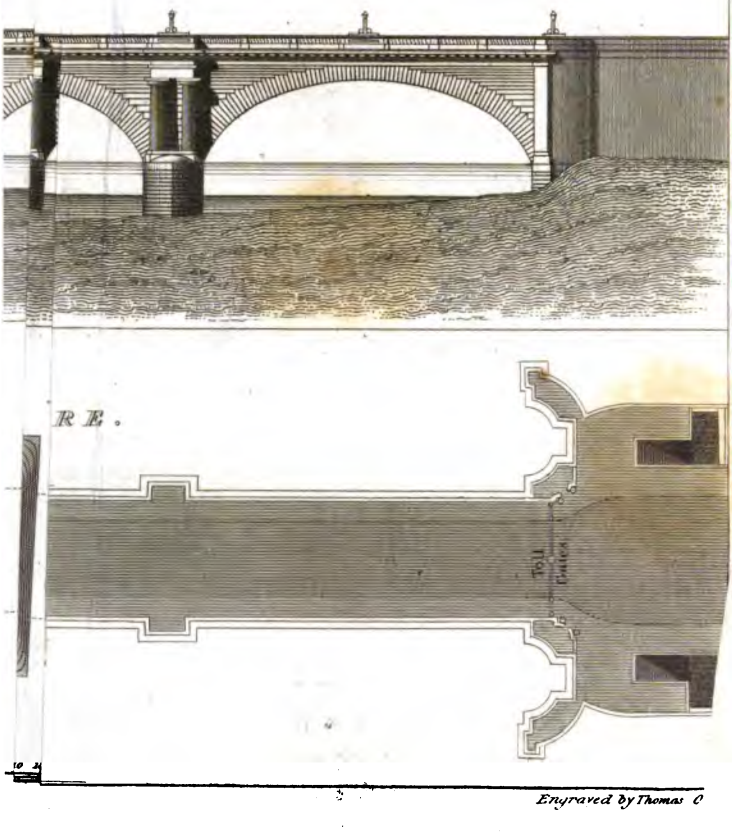


Engraved by Thomas C

whole distance, and is formed by sixteen of the above described brick arches.

Having thus described generally the leading features of the Bridge as far as we have been able to ascertain them, we shall now proceed to a few of the details of the methods employed in the execution, and conclude this article with some general observations.

The foundations of the piers are laid level, about eight feet below the bed of the river; they are composed of numerous piles, having strong gratings of timber laid upon them longitudinally and transversely; the interstices are filled with stone, so that the whole forms a solid and compact floor for the masonry. There is a course of sheeting piles driven close round the gratings, to prevent their being undermined by the stream. The foundations of the abutments are done in a similar manner, and laid about eight feet below low-water mark. The whole of these foundations were laid in cofferdams of an elliptical form (except those of abutments, which were circular), and composed of two rows of piles driven considerably deeper into the bed of the river than the depth of the intended foundation, and strongly connected together by bolts, diagonal braces, &c. The space between the above two rows of piles was filled with strong clay, well puddled to the height of two or three feet above high-water-mark. The water was extracted from the foundations by pumps worked by steam-engines placed on the dams, so that the workmen continued their operations at all times of the tide without obstruction from water, whereby they were enabled to perform the work in the very best manner, an object of the greatest importance in works of this sort, particularly in a great tide river like the Thames, where they are so peculiarly exposed to accidents.

The form of centering employed was, that of a truss

 spanning

spanning from one pier to another, and nearly similar to those employed at the building of Blackfriars and Westminster bridges. Every centre was composed of eight trusses or ribs, each end of which rested upon a separate set of wedges supported by trussel legs bearing upon the offsetts of the piers; the whole when fixed in their places were braced together diagonally and transversely, forming as it were one complete truss. The number of centres employed was three, and these were removed alternately to the different openings as the progress of the work required, so that three were always standing at one time.

The removing of the centres from one opening to another was extremely simple, and was conducted in the following manner: The centre to be removed having been previously struck and disengaged from the different braces, &c. attached to it, thus leaving each of its ribs free from another. A barge built for the purpose, and containing a properly constructed frame-work was then floated directly under one of the ribs just before high-water, and there allowed to remain until the gradual rising of the tide lifted it off the wedges, it was then transferred to another opening, and there deposited upon two other sets of wedges by the falling of the tide; the remainder were removed in a similar manner. The whole operation in fine weather generally lasted about eight days; but when two tides happened in daylight, it did not occupy more than four or five days; thus was one of the most difficult and laborious operations rendered easy, which otherwise would have cost much trouble and expense without attaining the desired object so effectually. The weight of each rib was about 40 tons, making 320 tons in all, exclusive of covering.

The centres above described were found upon trial

to be very well adapted to their intended purpose, for we believe no instance occurred of their sinking or yielding in any respect contrary to the calculations. There were a variety of other machines employed, but as these did not differ materially from those before in use we shall not describe them.

The whole of the stone used in the exterior of the work is Cornish granite, (except the ballusters, which are of Aberdeen granite) and consists of blocks of various sizes from three to six and a half tons in weight each. A considerable quantity of hard freestone from various parts of England and Scotland is used in the interior of the abutments, piers, &c. where no extraordinary weight is to be sustained; the arches, however, are for the most part granite.

The total quantity of stone employed is, we understand, about 89,000 tons, the total quantity of brick-work about 2,450 rods. The different materials were transported to the work on a service bridge constructed across the river, and upon this were laid railways, &c. to facilitate the conveyance.

On the 1st of March, 1811, the first pile was driven, and on the 11th of October following the ceremony of laying the first stone was performed privately by Henry Swann, Esq. M. P. Chairman of the Committee of Management, in presence only of the Directors and a few friends; the works have since continued with unremitted attention and perseverance, without any accident or failure worth mentioning, and the bridge was finally opened to the public on the 18th day of this month, June, by the Prince Regent, the Duke of York, the Duke of Wellington, accompanied by a brilliant retinue of Nobility, &c. being

 the

the anniversary of the Battle of Waterloo; thus occupying from the very commencement only the space of six years three months and eighteen days; exhibiting, we believe, an example of expedition rarely equalled in works of this magnitude.

The contractors were Messrs. Jolliffe and Banks, and much to their credit have acquitted themselves, as we believe, to the satisfaction of the engineer and the company. We understand this undertaking is highly indebted to the liberal and enlightened exertions of Henry Swann, Esq. M. P. who has from the very commencement given the concern his whole support and patronage; nor should the labours of Sir Joseph Yorke, Mr. Brogden, M. P. the Rev. Mr. Rush, Mr. Morris, and several other highly respectable and eminent individuals, be overlooked; and it would be hardly pardonable were we to withhold our humble tribute of admiration from the whole of the very numerous and respectable list of subscribers, who in the midst of a war of unparalleled pecuniary pressure, have raised among themselves the immense sum of a million sterling, and nobly combated every difficulty, and brought this great enterprise to a successful conclusion. That such spirit and perseverance may be amply rewarded, must be the unanimous wish of every sincere friend to the Sciences and the Arts.

Length of the brick arches in the Surrey approach	766 feet.
Ditto of those in the Strand approach	310 feet.
Total length of the bridge from the ends of abutments	1380 feet.
Total length of the bridge and brick arches	2456 feet.

*** We

*** We are credibly informed, that his Royal Highness the Prince Regent has himself subscribed to the undertaking; and, as a further mark of his approbation, has ordered a medal to be struck, and presented to every Proprietor.

Description of a Machine for communicating Rotary Motion. By the Chevalier BAADER, *of Munich.*

With a Wood Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal was voted to Chevalier BAADER *for this Communication.*

I BEG leave to offer to the Society of Arts the plan of a mechanical invention, which I have executed with success in my own country, but which is not yet known in this, nor published any where.

It is a method of communicating rotary motion to a considerable distance from the person or persons who turn the machine, and without the use of wheels or pinions, band-wheels, or any other of the usual means. I made use of it in an hydraulic machine, to raise water from the foundations of houses, &c. the workmen standing on the bank or firm ground, and giving motion to an axis with cranks placed over the water.

I flatter myself that this invention will be found worthy the notice of the Society, as its utility is perfectly ascertained by the experience of a number of years in Germany; and, as its application may also prove beneficial to this country in many instances.

I am confident that the mere inspection of the plan will enable the Mechanical Committee to judge of the merit

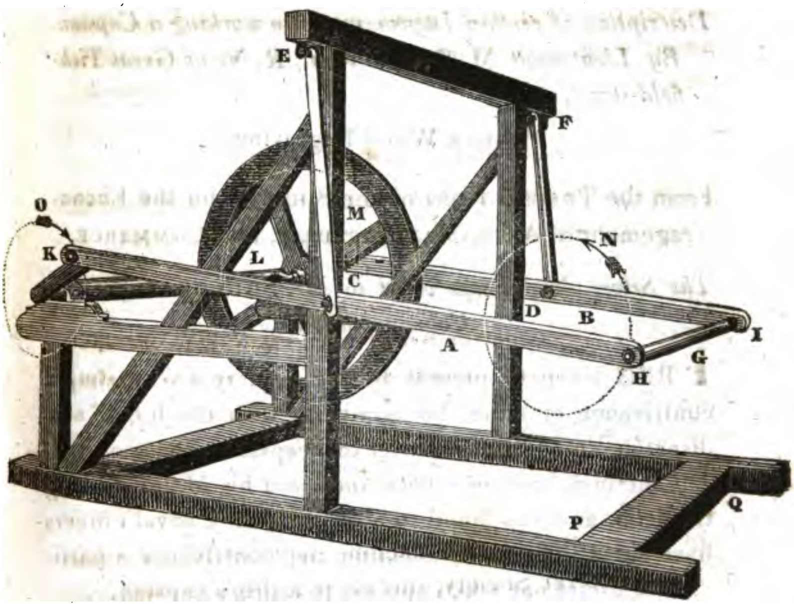
merit and effect of this invention; but should it be found necessary, I will with great pleasure attend the Committee, to give any verbal explanation that may be required.

Reference to the Engraving.

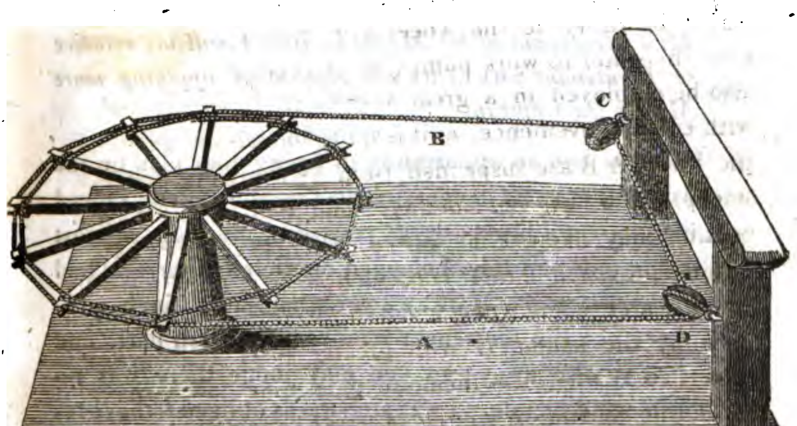
The two levers A B, turning on the centres C D of the moveable bars E F, suspended on their centres E F, attached to the frame of the machine, having a turning handle G, which connects their ends H I, and being attached by cranks of the wheel and axle K L M, at their other extremities, communicate any rotary motion given to the handle G to the wheel and axle, but in a reversed direction, as marked by the arrows N O; and this without the use of wheel-work, band wheels, &c. as hitherto done.

In the drawing of the machine sent by the Chevalier de Baader to the Society, this contrivance was employed to communicate rotary motion given to the handle G, by labourers standing upon the platform, P Q, of the machine, on the bank of a reservoir, &c. from which water was to be raised to the wheel and axle K L M, placed over the water to work pumps, &c. as required. It may also be employed in a great variety of other situations with equal convenience, as it is quite immaterial whether the levers A B are suspended from above, as in this instance, below, or even sideways; and their points of suspension may likewise be varied, when necessary, by a suitable provision in their construction, so as to be placed either nearer to the wheel and axle, in order to act upon them by the handle G with greater leverage, to gain power, or farther from them, to gain time; as the handle G, then moving in a circle of lesser diameter, can consequently be turned more swiftly about.

Chevalier Baader's Rotary Motion.



Lieut. M. Shuldham's improved Capstan.



Description of certain Improvements in working a Capstan. By Lieutenant M. Shuldham, *R. N. of Great Titchfield-street.*

With a Wood Engraving.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The Silver Medal was voted to Mr. Shuldham *for this Communication.*

I BEG leave to present to the Society a very simple contrivance of mine, for applying, with much ease and dispatch, an additional power to a capstan when required. The method has been tried on board his Majesty's brig Cordelia, and was found to answer. Many naval officers have also approved it, deeming the contrivance a particularly useful one when applied to a ship's capstan.

Copy of a Report of Lieutenant George Eyre Powell, *First Lieutenant of his Majesty's Brig Cordelia, relative to Lieutenant* Shuldham's *Method of applying more Men to the Capstan.*

"I have had an opportunity of trying your plan on the capstan; it answers in every respect as you stated; indeed it is too great a purchase, as yesterday morning, against a strong gale and tide, I clapped on your swifter, and had the pleasure to carry away a seven-and-a-half inch messenger; got the messenger removed to a fresh part, and carried it also away; so you may judge there was no foolish wind or tide. I was afterwards obliged to have recourse to a runner and pendant: the messenger was quite

new when we left this place, and had not been used more than five or six times."

(Signed) G. E. Powell, First Lieut.
Sheerness, Feb. 9, 1816. Brig Cordelia.

To Lieut. Shuldham, &c.

Certificate.

I hereby certify, that I have seen Lieutenant Shuldham's contrivance for the application of additional men to a capstan, when it is required to heave a great strain, and have no doubt of its efficacy; and, as it is not attended with any trouble or expense, I think the invention, when known, will certainly be generally adopted, its simplicity and utility being obvious.

(Signed) A. Brown, Commander, R. N.
April 26, 1816.

To Lieut. Shuldham, &c.

Reference to the Engraving.

In addition to the usual manner of placing men between the capstan bars, the ends of the bars should have notches or gaps made in them, in which an endless rope A B is received, and passes through two pulley blocks C D; thus forming two straight lines, along which men being placed can act by pulling the ropes in the most efficacious manner upon the capstan.

Description of a Machine for smoothing or blocking Straw Hats. By Mr. THOMAS SCORRAR, *Green-street, Bennet's-row, Blackfriars-road.*

With a Wood Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

Ten Guineas were voted to Mr. SCORRAR *for this Communication.*

I HAVE invented a machine for blocking straw hats, which I have sent to the Society, in hopes it will meet their approbation. The model now sent is half the size of the real machine. The price of a proper machine is 6*l.* 10*s.*; which money the workmen, at the common price of 6*d.* *per* hat for blocking, can gain by its use in one week's time.

A steel face is soldered on the box containing the heater, in order to give a better polish to the hat.

CERTIFICATES.

This is to certify, that the machine invented by Thomas Scorrar, for blocking straw hats, has given general satisfaction, and is much to his credit; for we can block fifty hats in a day sooner, and with much more ease, than we could block twenty in the usual way. This is only part of its utility, for having so much power with the lever, and going quick over the straws, it prevents the straw from being injured in colour. In the common mode, the hand-iron is obliged to remain longer on the straw, to press it down, and discolours the straw much; besides

which

which inconvenience, many persons have fallen victims to disease, from the labour of pressing with the hot iron against their breasts, which this machine will prevent.

Witness our hands, April 25th, 1815.

SAMUEL NICHOLLS, Straw Hat Manufacturer, at No. 5, London-Road, Southwark.

THOMAS SWINSCOW, Stone's End, Bow.

WILLIAM MORRIS.

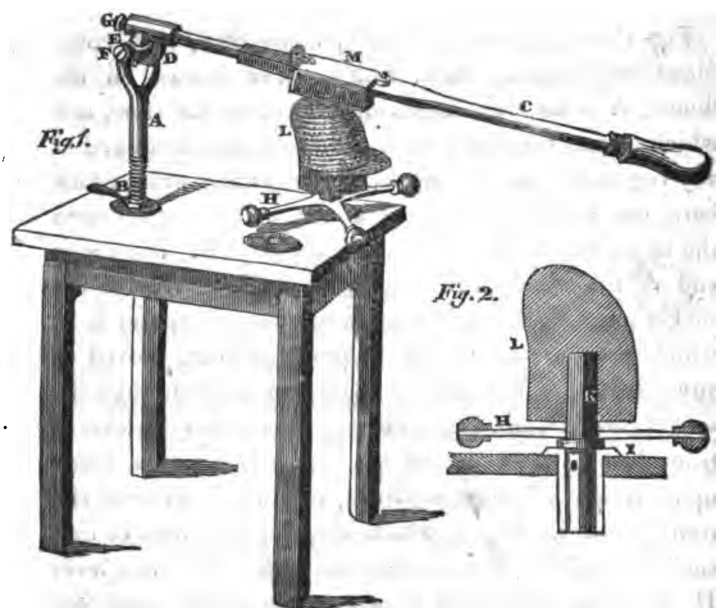
REFERENCE TO THE ENGRAVINGS.

Fig. 1 is a representation of the machine, in a combined and working state, with a straw bonnet on the block; A is an iron standard, screwed on the stem, and which passes through a table, and to which it is fixed at any required height by means of two counter nuts or lock bars, one acting against the under, and the other upon the upper surface of the table, as shewn at B. The upper end of the standard is forked, as at E, to receive the socket piece D, through which a screw or pin passes at F, which gives to the lever C the power of being moved in any direction. The lever C slides and turns through the socket piece D, and a nut or stop at G prevents the lever C from being drawn out of the socket B. L is a block upon which a bonnet is placed, and which fixes on the iron spindle K, Fig. 2, which revolves in a brass or iron socket, which is screwed upon the table. The cross lever H turns the block and spindle in the socket, and thus presents any part of the bonnet to the box-iron M, attached to the lever C. A red hot iron is enclosed in the box M, the lid of which has a joint, which admits of its

opening, and a button or catch which keeps the lid shut during the operation of ironing or smoothing the bonnet. By this machine any size or figure of a bonnet and hat may be ironed or smoothed with great dispatch, accuracy, and convenience to the operator.

Fig. 2 is a section of the block, spindle, and lever, the same as described in 1.

Mr. T. Scorrar's Machine for smoothing Straw Hats.



Hints

Hints on the Processes of British Wine-making.

By Dr. MACCULLOCH, *Woolwich.*

(Continued from Page 62.)

WE can also see, that we are limited in the application of our own fruits, and that we cannot avail ourselves of all the use which we might derive from their natural sugar, nor in some cases from their leaven, least we should introduce too large a portion of their malic acid; that acid in which they are too apt to abound, and which I have already stated to be ill adapted to the formation of genuine wine. They who shall attempt to make wine from the juice of the currant or gooseberry alone, will feel practically the force of this statement. We also may see from these general principles, that we are not necessarily limited to the use of fruits; since, being indebted to the fresh vegetable for very little more than the extractive and fermenting matter, we are permitted to seek it, even among leaves and roots.

But to return to the agents engaged in fermentation; water is one of these, and we have seen, that a certain degree of fluidity is essential to this process. If a mixed solution of sugar and leaven is concentrated to a certain degree, it refuses to undergo the act of fermentation, or enters into it with difficulty. For the same reasons, its progress is so slow, that the result is generally a sweet wine; since the operator, accustomed to regulate his processes by time, rather than by the changes which the liquor experiences, is apt to conceive it finished before it is well established, and thus to suspend it, by the operations of decanting and clarifying, before the liquor has suffered all the changes of which, in due time, is is capable.

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When the juice to be fermented contains, on the contrary, too large a proportion of water, the fermentation is equally slow and difficult, but the produce is weak, and runs readily into the acetous stage. Thus, weak currant juice exposed to fermentation, is converted into vinegar, by a gradation so regular, that it can scarcely be said to form wine, during any part of its progress. In wine countries, these opposite evils are remedied, either by dilution or concentration. The artificial composition of the fluid used in the domestic manufacture, admits of more ready remedies, already sufficiently obvious from the preceding remarks.

Having examined the nature and re-actions of the ingredients to which the process of fermentation is owing, it is now proper to attend to the external circumstances which affect and regulate it, before any rational processes can be adopted for its conduct.

Temperature is one of the external circumstances which has the greatest share in influencing the act of fermentation, and that of 54° has been considered the most favourable. Some latitude is, however, to be allowed; but in a temperature either very high or very low, this process does not not go on at all. Attending to this circumstance, we are enabled to regulate the process when it does not proceed regularly, either by cooling the fluid to check its too rapid progress, or by warming it when it proceeds in too languid a manner. By this we can also explain a phenomenon of common occurrence in wine-making, a renewal of the fermentation which takes place in spring, after it has been partially or entirely suspended by the cold of winter. This is a subject worthy of attention, as some important practices in the art depend on it. Thus, if we are desirous of making a wine to imitate *Champagne*, it is neeessary to watch for the period when

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the fermentation is re-excited by the arrival of spring. By bottling in this stage, we insure a brisk wine, which if bottled either in the cold of winter, or after the second fermentation has been exhausted by the heats of summer, would be dead or still. This renewal of fermentation, or *fretting*, as it is sometimes called, is also a favourable time for the addition of flavouring matters, as they then give out their flavours and combine with the wine. It is at this time also, that spirits should be added to the wine, if it is ever allowable to make this addition. It is the only time at which alcohol can safely be added without destroying its vinosity, as it then enters into a kind of chemical combination with the wine.

It is necessary likewise to consider the effects which the *air* produces in fermentation, although its presence may rather be considered as favourable than essential. If the liquor is shut up in close vessels it does not readily ferment, although it still slowly undergoes this process, and is at length converted into perfect wine. It is ascertained, that no air is absorbed during the vinous fermentation, although this happens in the acetous, but that the free and ready disengagement of the carbonic acid is the principal circumstance in which fermentation in open vessels differs from that in close ones. One important fact, however, is established,—that the wine is stronger when the fermentation has been either partially or totally carried on in close vessels, and that the flavour is also better preserved; and it appears that a great part of the alcohol produced is dissipated by the carbonic acid, which holds it in solution, and which produces a well known effect, both on the organ of smell and on the nervous system in general, when this disengagement is made in the stomach. It is not yet well explained, how the carbonic acid is disposed of when produced in close vessels.

vessels. Many of the practices followed in making particular wines depend on a consideration of these two modes of conducting the fermentation; but it rarely happens that an exclusive fermentation in close vessels is used. This is generally reserved for the last and most tranquil stage. A consideration of the effects produced by these different methods, and of the products which we wish to obtain, will be necessary to guide us in our choice of either of these two processes, or of a certain admixture of both. If the wine is meant to be still, and if it is not desirable to husband the strength and flavour, the whole fermentation may be carried on openly. This will be the case with strong and sweet wines. If, on the contrary, a wine of the character of Champagne is intended, which must retain its briskness, flavour, and strength, we must be guided in our practices by rules similar to those in use in that and other districts of France, and adopt a partially close mode of fermenting. In all cases it appears to be a useful practice, even if the first fermentation is carried on in an open vat, to exclude the free access of air, by covering the vessel with boards and blankets. If the first fermentation is carried on in the vessel in which the liquor is meant to continue, —a case which can only occur when no solid matter is fermented with the fluid, a slight covering will be sufficient. Whatever process has been adopted in the first instance, the bung may after a time be lightly put down, and ultimately tightened, a spill-hole being added, to give an opportunity of relieving the vessel from time to time, of the elastic fluid which might endanger its safety.

The *volume* or quantity of the fluid is the last circumstance which requires notice, as influencing the act of fermentation. This process is more rapid and more perfect in large than in small vessels, and is often entirely

completed

completed in the course of a few days in a large vat, while in smaller vessels it may require weeks or months for its perfection. This question, interesting to manufacturers of *sweets* on a large scale, is of little moment to domestic makers of wine, among whom the quantity made at any one operation is generally small. But it is not quite uninteresting even to them, as it explains some of the difficulties with which they have to contend, and serves to direct and guide their operations. The same materials, for example, will not experience the same changes in equal times, if they are exposed to fermentation in the quantity of two or ten gallons; and time will therefore be allowed by the operator, in a ratio the inverse of the bulk of the fluid on which he is operating. I may also remark, that if there be a flavour to preserve, it will more readily be secured when the fermentation is slow, and the mass of fluid small; and that the sweeter and thicker juices require to be treated on a larger scale than the thinner ones. It is easy to make lemon wines in a cask of two gallons, but it is a very difficult task to operate on so small a quantity of thick and sweet raisin wine. This is one of those general principles which, together with the quality of the liquid, the temperature, the proportion of leaven, and the other circumstances which I have inculcated, ought always to be present to the maker of wines, since it is only by conforming to the complicated actions of these various causes, that he can hope to secure certainty or uniformity of result.

I may pass lightly over the phenomena which occur during the process of fermentation, which, however important to a general view of this subject, are, from their minor share of practical interest, more easily dispensed with, than those details which are necessary to the unphilosophical practitioner.

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The act of fermentation is marked by the extrication of air bubbles, and by the agitation and turbid appearance of the liquor. The turbid matter is shortly separated into two portions, which in part rise to the surface in scum, and in part subside in the form of lees. Both of these, as I have before shewn, have the power of continuing the act of fermentation; and it has also been shewn, that their separation, by decanting and clarifying, serves to check this process. For the same purpose, the cask is kept always filled to the bung-hole, so as to admit of the disengagement of the scum or yeast as fast as it is formed. The bulk of the liquor is increased during fermentation, partly in consequence of the heat excited, and partly from the extrication of the carbonic acid gas which is separated. It will be obvious, how the practices required in regulating the qualities of all wines must be deduced from this general fact respecting the management of the yeast during its production, and that the manipulations must be different when either a sweet or brisk, or a still and dry, wine is desired. In the former two, the fermentation will be checked, by filling to the bung-hole; in the latter the yeast will be allowed to subside.

The *carbonic acid* is not necessarily separated and disengaged from the wine, since the brisk wines of Champagne owe their sparkling quality to a portion of it which is retained by them, either in consequence of the period of bottling being duly chosen, or to a portion of leaven allowed to remain in the bottled wine, and which has a tendency to renew the fermentation under confinement. This quality is sought after in many wines, and it is often, in the worst class of Champagne wines, the only valuable one which they possess. It is owing to the necessity of having a superfluous quantity of leaven for

producing

producing this effect, that a brisk wine is with difficulty made, unless a portion of unripe fruit enter into the composition. This is the case with the wines of Champagne, and equally so with the produce of our gooseberry, which has been conceived to resemble them.

I have already mentioned, that the carbonic acid of fermentation is supposed to contain alcohol, and thus, by fermenting in closed vessels, a great part of the spirit of the wine which would be dissipated is retained and preserved.

Heat is also generated during fermentation, and to such a degree, as often to require tempering; but as this can only occur in manufactories on a large scale, I need not dwell on it.

The *colouring matter* of the fruit is extracted during this process, since the darkest grapes yield but a white wine, if their skins are not fermented in the liquor; and by attending to this fact, we can regulate the colouring of our wines at pleasure, if the fruit possesses this principle.

The last and most important effect of fermentation is the *formation* of *alcohol* or *spirit*, and this depends collectively on the proportion of sugar in the entire fluid, on the due proportion of the leaven to that sugar, and on the perfection of the fermentation. The whole of the sugar is seldom decomposed during the first process of fermentation; but a proportion is generally attached even to the wines considered dry, long after they are tunned or bottled. It is only by a slow continuation of the same actions in casks and bottles,—a process often requiring many years for its completion,—that the sugar entirely vanishes, and the liquor is found to consist of alcohol, combined with the other matters which join it to form wine. It is important to consider the effects pro-

duced on wine by a portion of undecomposed sugar remaining in it. As long as this exists, the acetic fermentation cannot take place, and it therefore offers a test of security against this result, in our ill-made domestic wines. In the natural wines, the balance of principles appears to prevent this occurrence, even when all the sugar has disappeared, and thus Hock, Claret, and Madeira, seem to be possessed of the power of endless duration.

All care will be unavailing, if the process of fermentation, and its application to practice, be not thoroughly understood; and I shall therefore deduce, from the general doctrines laid down above, some further rules which have been cursorily passed over. If all the favourable circumstances already described are present, the act of fermentation goes on without any assistance, by the action of natural causes. The circumstances which are capable of impeding these natural actions, exist either in the quality of the liquor, or in the temperature to which it is exposed. When the liquor is a natural *must*, like the juice of the grape, it rarely labours under any other defect than the want of saccharine matter,—a defect which the experience of wine countries has found the means of correcting by the addition of sugar of honey, or of *must* evaporated by boiling, until it has become a thick saccharine fluid. The same defect is also sometimes remedied, by partially drying the grapes, or by adding burnt gypsum, or plaster of Paris, to the *must*, so as to absorb the superfluous water. It is evident, that as the maker of domestic wines has always an artificial fluid on which to operate, he need never be subject to any inconvenience from this cause, as it is in his power at all times so to compound his *must*, as to render it answerable to the requisite conditions. The management of the fermentation,

fermentation, when it has actually commenced, must also be regulated by the views of the artist, respecting the wine which he wishes to obtain. If sweet, the proportion of the water, as well as that of the leaven, to the sugar, must be reduced in compounding the *must*, or his *working receipt* must be modified to this end; and the management of the fermentation will then be such as to discharge the yeast as fast as it is generated, by keeping the cask full to the bung-hole, and by a careful repetition of decanting and clarifying. If, on the contrary, the wine is to be dry and strong, the proportion of the leaven will be increased, and the yeast will be agitated with the liquor, by rolling and stirring, so as to protract the fermentation. If the wine is to be brisk, the proportion both of leaven and water will be increased; and the fermentation will not only be conducted in vessels partially closed, but the liquor will be bottled and secured, before the fermentation is finished. The management of the temperature is easily deduced from the general doctrines. When the fermentation languishes from defect of heat, it is necessary to introduce a stove into the apartment where the process is carried on, or by heating a portion of the liquor, and mixing it with the mass, the temperature may be elevated to the most favourable point. Injurious changes, arising from variations of the external temperature, may be warded off, by a covering of straw or blankets. These attentions, trifling as they may appear, are by no means unimportant, since they are sufficient to cause the whole difference between good and bad wine. It is owing more to varieties in management than to radical differences in the qualities of the grape, that the wines of different countries differ so widely from each other, and that the wines of France, for example, possess a superiority so decided over all others.

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The limited nature of this little essay prevents me from entering on the chemical theory of fermentation, a subject still very obscure; and I shall therefore proceed to consider the management of wines after fermentation, a subject of more practical interest.

Many popular practices in the after-treatment, and in the suspension of fermentation, are founded on positive precepts respecting the time which the process has occupied. But time is but one out of the many elements which should enter into this calculation; since it has already been seen, that it is modified by the varying quality of the fluid subjected to that process, by the temperature, by the mass, and by many circumstances which it would be superfluous to repeat. Other rules, which are apparently better founded, since they are deduced from the appearances after fermentation, may yet deceive us, if they are too implicitly followed, without a due regard to the ultimate intentions of the operator, respecting the quality of his wine. Neither the smell, taste, or colour of the fluid, nor the activity or cessation of the fermentation, are positive guides. As the prime object is to convert the sugar into spirit, it is evident that the fermentation must continue longer, if the produce is to be a dry wine, and the reverse if a sweet one. If, on the contrary, it is the wish of the operator to preserve the flavour or *bouquet* of the wine, the period must be shortened. The case will be the same if a brisk wine is wanted, as the carbonic acid on which this property depends, would be irrecoverably dissipated, by an undue protraction of the fermenting process. As all wines are reducible to the four general divisions, of dry and strong, sweet, light and flavoured, or brisk; it is plain, that a regard to this ultimate object, their quality, must determine the mode of proceeding. If it is intended, for example,

ample, to make that kind of dry wine which is made in this country from raisins and sugar, the same practices will be necessary which are followed in the countries where wines are made from the grape for distillation. In this case, the wine is suffered to remain in the vat for three, four, or more days, until it ceases to have a saccharine taste, and till the whole of the sugar is converted into spirit. If it is intended to make a strong and sweet wine, the fermentation must be discouraged, by speedily removing it from the vat to the cask, and by the further use of processes hereafter to be described, which suspend and ultimately destroy the fermenting process. If it is desired to produce a light and flavoured wine, like those of Burgundy, for example, the practices should resemble those followed in that country. There, the *must* is allowed to remain but a few hours in the vat, the time varying according to the quality of the *must*, the temperature, and other accompanying circumstances. The period is, *cæteris paribus*, always shortened, when flavour or perfume is expected from the wine; a precaution, however, which the maker of domestic wines may dispense with, as the little flavour he has to expect from the fruits of his own growth, is generally better avoided. Further, if it is proposed to make wines brisk, and resembling those of Champagne, the juice must remain in the vat but a few hours; and indeed when small quantities only are operated on, it is often prudent to conduct the whole process in the cask, even from the commencement.

I cannot conclude these general directions, without inculcating the necessity of cleanliness in the use, and care in the selection of the casks, since results otherwise promising, are often destroyed by this minor sort of negligence.

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In removing the wine from the vat to the cask, it is necessary to get rid of all the insoluble and superfluous matter which it may contain. This removal is in fact the first stage of decanting,—an operation of which the careful conduct is of prime importance in this manufacture. By tapping the vat at a due distance above the lee, and by stopping the flowing liquor before the scum has descended too low, this separation is in general easily effected. In some cases, straining may be required; but in all, the scum should be carefully removed, as it is from exposure apt to acquire either a musty taste, or acid property, easily communicated to the liquor. In the wine countries, the solid matter is exposed to the wine press. Here it would not be an object worthy of the labour required.

The wine thus far advanced, still undergoes a fermentation in the casks, more languid, yet necessary to its completion. If this process be suffered to go on indefinitely in those wines of which the saccharine matter has been entirely decomposed, it will proceed to the acetous stage, and vinegar instead of wine will be the result; the natural tendency of fermentation being a progress from the vinous to the acetous stage, which, if not counteracted by circumstances in the wine itself, must be prevented by artificial expedients. The natural circumstances which prevent this change, consist in that state of proportion between the leaven and sugar, which allows part of this last to remain undecomposed after the process is completed, or a balance of principles so nice, as to terminate in a perfect neutralization of the two elements which conspired to produce it. This accuracy is perhaps seldom obtained, since the palate is unable to detect the last portion of sugar, marked as it is by the predominant taste of the wine, on the qualities of which

it nevertheless produces an advantageous effect. Knowing that the acetous process cannot take place while sugar remains unchanged in the fluid, we can regulate our conduct in the use of the artificial means of checking fermentation above alluded to, since any anxiety on this head is unnecessary while the wine continues sweet. We can also see from the same considerations, how the addition of sugar to a wine whose durability is suspected, may prevent the acetous process from taking place; although, when this process is once established, it would be, according to circumstances, either unavailing, or the cause of a speedier conversion into vinegar.

I must now describe the artificial means by which fermentation may be checked or stopped, in those cases where a natural termination would not occur. Those most generally used, are racking and fining, of which the object and effects must already be intelligible to those who have read the preceding remarks. Turbid wine is in an unfinished state, as well as in a precarious one, and its brightness and purity is not merely an ornament, but a property necessary to its permanence. It is from being left in this state, that wine frequently becomes *pricked*, this disease being the first stage of the acetous fermentation, but one which may also originate in other causes already explained. But although racking and fining may disengage the wine from all precipitated leaven, it will not separate that which is held in solution, and of which the tendency is equally to destroy the wine at some distant period. For this purpose, chemical means are required, and the process in common use, is known by the name of *sulphuring*. Many unnecessary and complicated methods are resorted to, for this end; the most simple is equally effectual, and consists in filling the empty cask with the vapour of sulphur, from

burning matches placed in the bung-hole. The wine is then introduced into the cask, and if this first operation is found insufficient, it may be repeated as often as is necessary. When the *leaven* is so abundant, that a very large quantity of sulphureous acid is required, as in many of the wines of Bourdeaux, a portion of wine, impregnated with the gas, by a process similar to that of the silk-bleachers, is used for mixing with the wine in the cask. The sulphate of potash offers itself as a convenient substitute for this operation; and in the quantity of a drachm or two, it is sufficient in general for a large cask of liquor. Other chemical agents, capable of accomplishing this end, might be enumerated; but the operation of the whole is similar, and consists in precipitating, and rendering insoluble the leaven which was contained in the wine. It is obvious, that this process must be followed by that of racking and fining. The substances used for fining, are most commonly isinglass, or the white of eggs, and the mode of applying them is universally known. Sand, gypsum, starch, rice, milk, blood, and the shavings of beechwood, have been found to answer the same purpose.

In the general practice of making wine from grapes, many expedients are in use, to remedy particular defects of colour, sweetness, flavour, sharpness, or dullness. As few of these are applicable to wines of domestic manufacture, I shall pass them over slightly. The causes and remedies of excessive sweetness, must already be obvious from what has been said. The causes of offensive sharpness, are either the excessive fermentation of a weak and watery *must*, or an undue portion of malic acid. In the former case, the wine is tending to vinegar, and although the evil may be palliated, it can scarcely be remedied, nor is it perhaps, in the case of our domestic wines, worth

worth the remedy. The use of lead, chalk, and other expedients, must be left to manufacturers. The mode of prevention, is more worthy of our attention, and it is obviously that of using a better *must*, or attending more carefully to the fermentation. That sharpness which arises from excess of malic acid, is well exemplified in hard cider. It is not a fit object of remedy, but may be prevented by a better choice of materials, or by the expedients alluded to in the beginning of this paper.

A disagreeable quality opposed to the former, is flatness, or a mawkish flat taste, which, though sensible to the acuter palates of those who are habituated to good wine, is scarcely perceived by those who are accustomed to the strong dull wines, so generally used in England. The light and quick flavour, so perceptible in the wines of France, disappears under the treatment by which the more fiery wines of Spain and Portugal, are made marketable in this country. At times, flatness may arise from age, or from the complete annihilation of the fermenting process; but the most common cause is the admixture of brandy or spirit. This addition, when used in excess, is not only injurious to the liquor, but to the constitution, as it introduces an additional quantity of ardent spirits, into a beverage already perhaps too strong. Its use is also in some measure founded on a mistaken principle, as it is resorted to, at least in this country, among the makers of domestic wines, for the imaginary purpose of checking fermentation, and preventing the occurrence of the acetous state. It has been shown by recent trials that alcohol does not check the acetous process, unless added in a much greater quantity than it is ever used for wines; and I have already pointed out the true principles on which the tendency to vinegar may be prevented. An idle notion is prevalent among makers of domestic wines,

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that they are deficient in durability. The unfounded nature of this belief, must appear from every thing which has been stated respecting the true theory of wine; and I may, here add, that the durability of these wines, is in fact shortened by the admixture of brandy, since it ultimately decomposes them, driving off their carbonic acid, destroying their brisk and sprightly taste, and rendering them vapid and flat, while at the same time, their salubrity is diminished, and their price increased.

If, notwithstanding this view, makers of wine are still determined to have recourse to the practice of adding spirit; I will now point out the least injurious manner in which it may be effected. It may be added to the liquor before fermentation,—a method in use in the manufacture of sherry. It may also be added, during the subsequent renewals of the fermentation, which have a sort of periodical recurrence in the cask; the operation being founded on the practice known to wine-coopers by the term *fretting in.* When for any purpose it is found convenient to mix two varieties of wine, that time of spring is selected, when a slight fermentation is renewed, or this process is brought on by rolling or heating. A perfect union of the wines mixed at this period then takes place, a slight fermentation being induced, which serves to unite the whole into one homogeneous fluid. It is under similar circumstances, that brandy may be added, and it then enters into a combination with the wine, more nearly resembling that natural union in which alcohol exists in this fluid; while at the same time it produces less injury, either to the flavour of the liquor, or to the health of the consumer.

The sketch which I have now given of the general principles of wine-making, may possibly suffice for the purpose of practice, and enable the practitioner to guide himself

himself by rules, both more correct and more generally applicable, than the positive ones on which he has hitherto proceeded. I shall now proceed to a cursory examination of the several practices in use in our domestic manufacture. The receipt books abound with details, which it is unnecessary for me to examine, as it would be a waste of time to comment on manipulations, which have been guided by no principles, of which a great number is manifestly absurd, and of which many others appear incapable of giving results at all resembling wine. I shall content myself with noticing the most prominent errors, and with pointing out those general practices in which the most rational receipts can be made to agree.

When we read in many of those books of receipts, directions for sulphuring the casks before fermentation; we must be convinced, that such directions have arisen from an utter confusion of ideas on the subject. The same remark may be made on another rule, of which the object is equally misapprehended; the mixing of white of egg with the fluid about to be subjected to fermentation. The proportions of sugar seem to have been allotted with equal want of consideration; and it seldom appears to have entered into the minds of the inventors, that the strength of the wine was to depend on this ingredient. The proportions of the fruits to the total compound, seem to have been dictated by similar caprices; their natural properties, whether of sugar, acid, or flavour, not having been considered in the views of the artist.

Those ingredients which are added for the avowed purposes of flavour, have been managed with similar want of judgment, and they have indeed often been supposed capable of communicating the strength, or vinous quality, to the liquor. Instead of being introduced at the decline

cline of the fermentation, they have been exposed to all its effects; in consequence of which, their flavour has often been volatilized or destroyed. This is the case with cowslip wine, where an enormous quantity of flowers is used, to obtain an effect which might be procured with a much smaller allowance. Such also is the practice with raspberries,—a practice worth noticing, since it affords an opportunity of stating the more correct and useful mode of proceeding. If an attempt is made to form wine from raspberries and sugar, a liquor will be produced with little or no flavour of the fruit; but a small quantity of syrup or juice of raspberries added at the decline of the fermentation, or a little fresh fruit suspended in the cask at the same period, will be sufficient to communicate a taste, more likely to prove excessive than defective.

But the most striking defects of the common proceedings are visible in the vacillation and uncertainty, with which both the fermentation and the subsequent processes are conducted. By using the yeast of beer,—a practice founded on ignorance of the nature and causes of fermentation,—a false and bad flavour is introduced, which is often sufficient to render the produce tainted and even nauseous. By want of attention to the process itself, and the circumstances by which it is affected, the artist is unable to advance or retard it, to alter or amend it; while, guided solely by rules founded on fixed periods, inattentive to his subject or its concomitancy, and undecided respecting the future character of his wine, it is not surprising if he meets with perpetual disappointment, producing still wine when he wished for brisk, or sweet when he intended to form dry. The same want of principles prevent him from taking advantage of the practices of sulphuring, racking, and bottling, as will be obvious

vious to those who shall compare the practices in daily use, with the more correct ones which have been laid down.

I must now proceed to give a view of the methods in common use, as far as they offer differences worthy of notice, confining myself to those varieties of domestic wines, which are either in themselves good, or capable, under proper management, of being rendered so. I shall take no notice of the projects to make wines from esculent roots, as I believe that they are misplaced; but limit myself to fruits, from different kinds of which, the several wines take their names. I shall also omit the grape at present, because, considering it as almost exclusively worthy of attention, I wish to treat of it in a separate paragraph.

The fruits chiefly in use are the quince, cherry, strawberry, sloe, elder-berry, damson, mulberry, black or bramble-berry, raspberry, orange, lemon, gooseberry, and the three varieties of currant. Dried raisins, although not ranking among our fruits, are extensively used, and require also to be noticed.

A wantonness of experiment seems to have, in some measure, led to this great and superfluous number of articles as the nominal bases of wines, although the practices have also been, in a great degree, founded on false views of the real nature and objects of this manufacture. It is evident, on the principles already laid down, that when no peculiar and agreeable flavour follows the adoption of any individual fruit, it can have no legitimate claim for use, beyond that which is founded on its several proportions of sugar, leaven, acid, colour, or astringency. As the two last of these can be communicated with the greatest certainty by adventitious ingredients, it is bad policy to have recourse to weak expedients for the

the same, and particularly, if, for the sake of these minor objects, we must sacrifice others of greater importance.

Since also the sugar is, confessedly, and in all cases, an adventitious ingredient, capable of being proportioned with the greatest nicety, completely in our power, and of a moderate price, it is unnecessary to consider that ingredient in fruits, as the one which is to guide our choice. It is to the due admixture of acid, and of leaven (the fermenting principle), that we are chiefly to look for the causes which are to determine us in our selection. If a good flavour can be obtained from any fruit of our own growth, we have then the whole data which should rule our determinations. The object of price, is a consideration which will naturally be added to these more important ones.

The Quince appears to have usurped a place in the foregoing list, to which it properly has no title. Its similarity in principles to the apple and pear, is sufficient to assure us, that its produce can only be a species of cider, characterised, according to circumstances, by the astringency and flavour which distinguish it from these two fruits. Its price and rarity also increase the objections to its use.

Vinous liquors, of no very particular character, may be made from the several varieties of Cherry; but the operator should be cautioned against the common practice of pressing the kernels in quantity, as, however agreeable a slight flavour of the bitter may be, a taste amounting to bitterness, is always unassimilating and injurious to the wine.

From the Strawberry, wines of agreeable quality, both dry and sweet, may be produced; but the peculiar flavour of the fruit is generally dissipated in the process. The cautions which I have given respecting flavour, will suffice

sire to point out in what way that is most likely to be obtained.

I make the same remark on the Raspberry, with this additional hint, that as very little in point of flavour or produce is gained by the use of these fruits, which are in most places of a high price, it behoves the operator to balance the advantages against the disadvantages, before he enters on the undertaking. A simple infusion of this fruit, as before noticed, in any flavourless currant wine, will, with greater cheapness and certainty, produce the desired taste.

Having no experience in the Bramblebetry or Mulberry, I am unable to say, whether any flavour can be communicated by their use. The cheapness of the former is a recommendation; and there is no doubt that they both contain the substances, leaven and acid, most essential for this purpose. They also afford what so few fruits do to the same degree, the colouring principle. In managing them, so as to derive the greatest advantages from their colour, it is necessary, that the fermentation be allowed to go on with the skins, until the colour is extracted, which will also be accompanied by the slight degree of astringency, which, at a certain period of ripeness, accompanies both these fruits.

The Sloe and Damson are so associated in qualities, that nearly the same results are produced from both,—a bitterish and astringent liquor, capable of being converted into rough wine of a good character, care being taken duly to proportion the quantity of fruit to the sugar, or to modify that liquor by the addition of other fruits of less decided properties. This is a case, in which it is necessary to protract the fermentation, so as to make a dry wine, as the peculiar astringency of these fruits, forms a very discordant association with sweet

 wines.

wines. By a due admixture of currants or elder-berries, with sloes or damsons, and with proper care, wines not much unlike the inferior kinds of Port are often produced. Since receipts are in the hands of every one, I need not detail the proportions, which ought, in fact, to vary, both according to the ripeness of the different fruits, and the particular views of the artist.

In naming the Elder-berry, I have mentioned a fruit whose cheapness and abundance have long recommended it to notice; and from which, with attention, excellent red wine can really be made. It seems to possess in great perfection, that portion of the extractive principle, which is required to produce a free and full fermentation; and its admirable colour communicates to the wine a tint as rich as can be desired. It appears to be deficient in acid; and its produce is consequently much improved, by the addition of tartar as an ingredient in the artificial *must*. Its natural sugar is so small in quantity, that it requires an ample addition of this fundamental ingredient. If it has no good flavour, it is at least free of any bad one,—a virtue which does not appertain to many of the fruits of current application in wine-making.

In apportioning the two several ingredients of tartar and sugar, the following rules may be of use.

Considerable differences in the dose of tartar may be allowed without producing any correspondent changes in the result, and the proportion of this ingredient has consequently been made to vary from one to four, and even six *per cent.* The causes of this admissible laxity will appear, when it is considered that the greater part of the tartar is deposited in the lees. I may also remark, that from two to four *per cent.* will be found a sufficient dose; and that in proportion to the greater or less sweetness of the fruit, the sweetest requiring the largest quantity of

tartar,

tartar, and *vice versâ.* The dose of tartar ought also to vary in proportion to the added sugar, increasing as this increases. Although pure tartar, or cream of tártar, may answer the intended purpose, the crude salt is to be preferred, because it already contains a portion of yeast conducive to the more perfect fermentation of the artificial *must.*

In proportioning the sugar, the following general rule may also be taken as a guide. Two pounds of sugar, added to a gallon of a compound, containing all the other ingredients requisite to a perfect fermentation, produce a liquor equal in strength to the lightest class of Bourdeaux white-wines. Three pounds produce one equal in strength to the wine known by the name of White Hermitage: and from four, if fermented till dry, a wine resembling in strength the stronger Sicilian wines, that of Marsala, for example, or the Cape Madeira, is produced, supposing these wines to be free of brandy. Where a fruit already contains sugar, it is obvious that the quantity of added sugar must be diminished in proportion to that which the natural juice may be estimated to contain, if we are desirous of accurate results. If in any case wine is to be left sweet, it is clear that this general rule cannot be applied, since sweetness and strength are, in the same wine, and from the same quantities of sugar, incompatible. The rules thus laid down, render any formal detail of proportions unnecessary, since they are readily deduced from the general view; and the circumstances which ought to regulate the fermentation and after-management, have already been so fully investigated in the first part of this essay, that it would be superfluous to repeat them. But, while on the subject of the juicy fruits, I may as well notice a part of the current practice which appears ill founded, and often attended with bad consequences. This is the large proportion of water,

and consequently small proportion of fruit, which is generally used, an usage apparently originating in a misplaced economy. If we attend to the common practice of making wine from grapes, that which ought to be the model for all our imitative operations, we shall see that no water is used, but that the whole fluid is composed of the juice of the fruit itself. If we now attend to the current practice, as recommended in our own domestic receipts, we shall find that the juice of the fruit rarely forms more than one-fourth of the whole liquor, and often much less, the proportion of fruit being seldom more than four pounds, including the solid matter it may contain, to eight pounds of water, and three or four pounds of sugar; and this proportion is fixed with no regard to the ripeness of the fruit, a circumstance of considerable importance. The consequences resulting from this sparing use of the fruit are highly injurious. It is plain, that the artificial *must*, thus compounded of water, sugar, and juice, must contain a much less quantity of the vegetable extractive matter, and of the native acid, than that which I have formerly shewn to be absolutely essential to a perfect and efficient fermentation. To put this case in a stronger light, let this proportion of juice be still further gradually diminished, and the *must* will soon consist of little else than sugar and water, a compound incapable of forming wine. Let it, on the contrary, be increased, and a vigorous and perfect fermentation, with a produce perfectly vinous, will be the result.

If green fruit is used, in which little or nothing exists but acid and extract, of which the former is in this case always in much greater proportion, bulk for bulk, than in ripe fruits, the acid would be too predominant were the juice of the fruit used in undue quantity. Their dilution is absolutely necessary, and of this practice I shall

take

take occasion to point out examples hereafter. But if the fruit be ripe, the acid is diminished in quantity, and cannot therefore bear to be still further diminished by excessive dilution. It will accordingly be found, as I shall again have cause to shew, that a much more perfect wine is produced by diminishing the water, or increasing the proportion of fruit.

As the *orange* and *lemon*, although not native fruits, are familiar to us, and scarcely differ in their chemical composition, I may safely consider them in one view. So little difference exists between the citric acid which is found in these fruits, and the tartarous which characterises the grape, that it is natural to expect their produce to be of a good quality. They are, however, deficient in extractive matter or leaven, and for this reason are incapable of being converted into wine, even with the aid of sugar, unless yeast or some other leaven be added. As it is impossible to add the yeast of beer in sufficient quantity for the perfect fermentation of the fluid, without spoiling the flavour, these wines are generally imperfect and sweet. They are likewise almost always corrupted in their flavour by the infusion of the peel, giving a taste, which, however grateful abstractedly, does by no means coalesce with the taste of wine. It would tend to the improvement of these wines, if the peel were to be omitted, and if any vegetable matter could be added capable of inducing the complete fermentation, without communicating a bad flavour. I have attempted it by means of gum; and with partial success. The principles I have already pointed out, will lead experimentalists to the search of proper substitutes for the natural leaven. It is not unlikely that they would be found in wheat; either in the flour or gluten.

The *gooseberry* is one of the fruits most commonly used,

used, and is in particular well known as an ingredient in brisk wines, which are made to resemble, in appearance at least, the wines of Champagne. For this purpose, it is used in an unripe state. It is well known in the wine countries that, independently of those causes of briskness in wines which consist in the management formerly described, this property always results from the use of unripe fruit, and is readily produced by mixing unripe grapes with the ripe ones. The case is the same with the gooseberry. The fault of this wine, however, if it be considered as an imitation of Champagne, is a bad flavour, which is almost invariably communicated by the fruit, and that in proportion to its ripeness. To avoid this evil, so generally injurious to the brisk gooseberry wines, the fruit can scarcely be taken in a state too crude, as at this period the flavouring substance has not been developed. At the same time the expressed juice alone should be used, care being taken to exclude the skins from the fermentation, as being the part in which the flavour principally resides. With these precautions, the noxious flavour may generally be prevented.

TO BE CONCLUDED IN OUR NEXT.

Information regarding the Carlisle and Keswick Codlin Apples, extracted from various Communications on that Subject, addressed to the Right Hon. Sir JOHN SINCLAIR, *Bart.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

THE Carlisle Codlin possesses the peculiar property of being fit for use at an earlier period of its growth than any other apple, making an excellent tart when no bigger

ger than the smallest plum; at which time also it is even useful to thin the crop. If blanched in boiling water, when of that size, the outer rind slips off, and they may be baked whole; their colour is then a transparent green; and their flavour is exquisite, resembling that of a green apricot. When it is about the size of a large nutmeg, it may be made into apple marmalade, or a dried sweetmeat, which rivals the finest Portugal plum. When fully ripe, in the beginning of October, it is not only much admired for baking, but is reckoned by some a good eating apple. It keeps well till February, when properly attended to.

The tree is hardy. It thrives without any particular attention, and may be planted nearer together than most sorts of apples. It does not seem to be subject to disease, and is supposed to be, on the whole, less liable to suffer in bad seasons than other apple trees. If propagated by slips, it generally bears soon, (in the course even of the first or second year); but when grafted, not earlier than other kinds, nor is the fruit reckoned so fine. The best, though not the usual mode of propagation, is, by slipping off small branches, which, near their junction with the stem of the tree, put out a sort of excrescence, with half-formed roots, similar to that of the apple called *Burknot*. The produce must of course depend upon the size of the tree, and other circumstances; but when properly treated, the trees are generally *loaded with fruit*, which ought to be removed *in succession*. Full grown trees will yield from ten to twelve Winchester bushels of fruit, worth from 8*s*. to 9*s*. *per* Winchester bushel. In England, they are frequently sold by the *hoop*, which contains in measure six quarts, and in weight is equal to one stone, fourteen pounds to the stone.

These trees are sometimes, but too seldom, planted in the

the gardens of the Cumberland cottagers, comparatively few of whom are possessed of gardens. Horticulture, indeed, is only in its infancy there, and is hardly yet become an object among the peasantry, who cannot be persuaded to throw away their time, as they are too apt to consider it, on gardening.

The Carlisle codlin requires some degree of shelter, a good loamy soil, which should be frequently manured; it is observed at least, that those trees which are thus managed, invariably produce most fruit.

The Keswick codlin tree has never failed to bear a crop since it was planted in the Episcopal garden at Rose Castle, Carlisle, twenty years ago. It is an apple of fine tartness and flavour, and may be used early in autumn. The tree is a very copious bearer, and the fruit is of a good size, considerably larger than the Carlisle codlin; but it begins to decay in the end of November or beginning of December, and consequently it is desirable to have some of both sorts. It flourishes best in a strong soil.

Both the Carlisle and Keswick codlin produce fruit, which may be used *in succession* from June to January, and even February. Much herbage, and perhaps even potatoes, might be raised under them in the gardens of cottagers; but other roots so planted, would not probably acquire any size, as is usually the case in such situations.

They may be had from all the nurseries in the north of England and in Scotland: The price is from 9*d*. to 1*s*. each. They may be planted at any time from October to March inclusive. They have answered uncommonly well, planted singly, or against a wall, or as standards, at Jedburgh,—in Dumfries-shire,—in Galloway,—and in Fife,—and in some places even near the sea; and are likely to be a very important acquisition to Scotch gar-

dens in general, more especially in the western counties, as Clydesdale, Dunbartonshire, Argyleshire, &c.*

The Hawthorndean codlin might be tried at the same time, which some have recommended for hardiness and produce.

Experiments and Observations on the Potatoe.

By Mr. Daniel Crichton, Gardener, Minto.

From the Transactions of the Caledonian Horticultural Society.

If you think the few following experiments and practical observations on the potatoe, are worth communicating to the Society, you may do so.

In 1803, I got a good kind of potatoe for seed-stock, from a friend of mine, who had planted the same kind for many years before that period. This sort I planted several years, with complete success, and without any appearance of curl. I make it a rule to pit those I intend for seed, immediately when dug out of the ground in autumn; and never expose them to the air but during the time they are preparing for planting in the spring. In 1806, however, I observed a little curl among them. In 1807, I happened to plant a quarter at two different periods: the first planted, turned out good as usual, and free of curl: the last planted had more than the half of curled. The seeds tubers were all cut at one time; but on account of the weather turning unfavourable for planting, the last half of the quarter was not planted until a month after the first. The seed was kept, during that month,

* In the more southern districts of Scotland, and still more of England, labourers might pay the rents of their cottages and small gardens, by cultivating the Carlisle codlin, and other fruits.

month, in a hamper, covered up with straw, in a shed, but not excluded from the air, which, in my opinion, was the reason of them curling. The truth of this opinion, I think is ascertained in the following years.

In 1808, I planted for a general crop, part of the first planted of last year's, which turned out well, and had no curl amongst them. This year I exposed to the air, for four weeks, as much seed as planted a row; they turned out all curled, less or more.

In 1809, I planted the general crop as usual; they turned out with not one curl amongst them. This year, I exposed to the air for three weeks, as much seed as planted a row; this row had more than the half of them curled.

In 1810, I planted the general crop as usual, which turned out well, and no curl amongst them. This year, I exposed seed to the air, for one row, one week; for one row, two weeks; and for one row, three weeks. They turned out as follows: the seed that was exposed for one week, had very few curled;—the seed that was exposed for two weeks, had about one-fourth of them curled;—and the seed that was exposed three weeks, had about the half of them curled.

In 1811, I planted the general crop, guarding as usual against exposure to air. It turned out well, and there was no curl amongst the plants. This year I planted several rows of those whose seed was exposed to the air last year, of which I picked those that had not the curl, that I could discern; but this year they turned out nearly all curled. I also planted a row exposed ten days to the air; half of them was curled.

In 1812, I planted the general crop as usual, which turned out well, and free from curl. This year I planted a row of those that had their seed exposed ten days last year,

year, of which I took those that were not curled. This year they turned out more than the half with curl.

In 1813, I planted the general crop as usual; had a good crop, and no curl. I this year exposed a few for one and two weeks for two rows, as I had done three years before, and found them turn out curled, in proportion as they had been exposed to the air.

I am now satisfied in my own mind, that the curl in the potatoe, is occasioned by the way the potatoes are treated that are intended for seed. I have observed, all around this part of the country, that wherever the seed-stock is carefully pitted, and not exposed to the air in the spring, the crop has seldom had any curl; but where the seed-stock is put into barns and out-houses for months together, such crop seldom escapes turning out in a great measure curled; and if but few curl the first year, if they are planted again, it is more than probable the half of them will curl next season.

I have merely stated the facts which I observed, and willingly leave the discussion of the theory to other hands.

Observations on Pruning and Training of Pear Trees.

By Mr. Alex. Stewart, *Gardener, Valleyfield.*

From the Transactions of the Caledonian Horticultural Society.

It has often occurred to me in pruning and training of pear-trees against a wall, that it was necessary to adopt some other than the common mode of pruning, so as to obtain a succession of young bearing wood, in place of trusting to the spurs, which, in a short time, become hard and cankery, and seldom produce any fruit, but at the extremity of the branches.

Training pear-trees in the fan-shape, has often been recommended and adopted, with a view to obtain a succession of young bearing wood, but in general it has been found not to answer the purpose in many respects. When trained in this way, the upper part of the tree is apt to get into too luxuriant a growth, thereby depriving the lower branches of their proper share of nourishment, which is so requisite in every part of the tree to render it fruitful.

Training in a horizontal direction, I conceive to be the most eligible plan, both for equalising the sap, and covering the wall in the neatest and most regular manner. Yet, from the general mode of pruning trees trained in this way, the branches soon become full of spurs and breast-wood, which turns hard and cankery in a few years, and seldom produces any fruit but at the extremity of the branches; consequently, the middle of the tree becomes barren more and more, as the branches extend on the wall. This deficiency is found to exist in most trees that have arrived at a bearing state, although every precaution has been taken in pruning and thinning the spurs to render them fruitful, which has in general proved ineffectual, and has led me to try the following mode of pruning:

The trees that I have under my management, had been planted about ten or eleven years ago, when I determined to alter the mode of pruning them. At this time, they were beginning to bear tolerably well, but it was only at the extremities of the branches; and the trees, nearly meeting each other on the wall, would soon have caused confusion. The trees are trained with an upright stem, and the branches in a horizontal direction. I began at the bottom of the tree, and cut out every second branch within a few inches of the stem on both sides, taking

2 three

three or four from each side of the tree; and upon other trees, I removed every second branch all the way up to the top. It is two years since I performed this operation, and the trees have made fine bearing wood, which I am in hopes will produce fruit this season. By taking out every second branch in this manner, I have been enabled to lay in a number of side-shoots from the branches that were left, which have formed fine fruit-spurs, equal to the young wood that is produced from the stem of the tree: The side-shoots, I intend to remove, as the others advance. In the mean time, I expect them to be of considerable consequence. Besides, the encouraging of these shoots prevents the tree from throwing out so much breast-wood, as it might otherwise do.

I intended to have taken out some more of the branches last year; but in consequence of a quantity of blossom-buds being on them, I deferred the operation until this season. After removing every other branch as I have before described, I then mean to begin with the other old branches that were left, but not until the young wood has arrived at a sufficient length, say four or five years; and after removing those branches, I mean to lay in side-shoots from the young wood that was first obtained, in the same manner as I do now from the old wood that is left. I have great hopes, as far as I am at present able to judge, that, by proceeding upon this principle, I shall always be able to keep a regular supply of fine young bearing wood in every part of the tree, which is the object at which I aim.

Should the Society think the method that I have adopted, worthy of their notice, it will give me great pleasure to communicate what further may result upon the subject.

Method

Method of defending Timber for Building from Attacks of the Seasons.

From LES ARCHIVES DES DECOUVERTES, &c.

THIS method is much more advantageous than that of soaking the wood in a solution of salt. It consists of a coating, which is prepared in the following manner. Three parts of slacked lime, two parts of wood ashes, and one of fine sand: the whole is sifted, and as much linseed oil added as is necessary, to form it into a mass, that may be managed with a pencil or brush: in order to render the mixture perfect, and more durable, the mass may be beat upon a marble. The wood only requires two coats, of which the first is laid on thinly; but the second as thick as the brush can do it. This coating, when well prepared, is impermeable to water, and resists the influence of the weather and the action of the sun, which hardens and renders it more durable.

Method of making an incombustible Varnish.

From LES ARCHIVES DES DECOUVERTES, &c.

THIS is a method of obviating, in a very great degree, the action of flame upon any substance whatever, thereby preventing its carbonisation, and consequently its combustion. A quantity of isinglass is dissolved in water, either hot or cold, and a similar quantity of alum is prepared at the same time; the two solutions being afterwards mixed together, the portion that is to be exposed to the flame is carefully moistened, and to be more certain it is twice moistened. The addition of a little

vinegar

vinegar increases the incombustibility. Wooden vessels may be exposed to a flame with this varnish on them, and their contents made to boil, as it does not prevent the transmission of heat, only the carbonisation.

List of Patents for Inventions, &c.

(Continued from Page 64.)

PHILIP HUTCHINSON CLAY, of London, Gentleman; for a combination of machinery, for the purpose of repairing and improving turnpike and other roads and highways, and preserving the same in good order. Dated May 22, 1817.

SETH HUNT, of the United States of America, now residing in Covent Garden, Middlesex, Esquire; for an improved escapement for clocks and watches, and chronometers. Communicated to him by a foreigner residing abroad. Dated May 22, 1817.

ROGER DIDOT, formerly a Paper Manufacturer in France, but now of Paddington, Middlesex, son of PETER FRANCIS DIDOT, Jun. late a celebrated Printer in Paris, deceased; for certain improvements upon the machines already in use for making wove and laid paper in continued lengths or separate sheets. Dated May 22, 1817.

GEORGE MANWARING, of Marsh Place, Lambeth, Esquire; for improvements in steam-engines. Dated May 22, 1817.

SETH HUNT, of the United States of America, now residing in Covent Garden, Middlesex, Esquire; for certain combinations of improvements in machinery for making pins. Communicated to him by a foreigner residing abroad. Dated May 23, 1817.

CHARLES

Charles Wyatt, of Bedford-row, Middlesex, Copper-smith: for a new method or methods of preventing any disadvantageous accumulations of heat in manufacturing and refining sugar. Dated June 3, 1817.

Benjamin Ager Day, of Birmingham, Warwickshire; for certain improvements in chimney ornaments, which said chimney ornaments are so constructed, that they may be used for fire-screens, flower or sweet jars, time-piece cases, candlesticks, toast-stands, and various other purposes. Dated June 3, 1817.

Gabriel Tigere, Duke's-court, Bow-street, Mid~~dlesex, Gentleman; for a process or method of manufac~~turing writing paper in such a manner as that it will be extremely difficult, if not impossible, afterwards to extract or discharge any writing from such paper. Dated June 3, 1817.

John Parnall, of Saint Anstell, Cornwall, Brazier; for a method of tinning, or covering with tin, sheets or plates of copper, brass, or zink. Dated June 10, 1817.

Thomas Whittle, of Chester, Wharfinger, and George Eyton, of the same city, Gentleman; for a new or improved kiln, for the purpose of drying malt, wheat, oats, barley, peas, beans, and other substances, by means of steam, assisted by air. Dated June 10, 1817.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLXXXIII. SECOND SERIES. August 1817.

Specification of the Patent granted to WILLIAM RUSSELL, *of Avery Farm-row, Chelsea, Engineer; for an Improvement upon Cocks and Vents for general Purposes, particularly useful to Brewers, Distillers, Private Families, &c.*

Dated November 19, 1816.

With a Plate.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said William Russell do hereby declare that my said invention, and the manner in which the same is to be put in practice, and carried into effect, is fully described, and will clearly appear from the following drawing and description. It consists of a certain cock and apparatus; by the use of which all casks or vessels in which liquors are to be kept may be supplied with that portion of air which must necessarily be admitted into them before the fluid will pass out, and which in ordinary cases is admitted by a vent hole, to be filled up by a peg or stopper, the careless use of which is fre-

quently found to be very detrimental to the liquors, by permitting their evaporation, or by suffering any gas which they may evolve to escape, or by opening a free accession of common air, by which fermented liquors become flat or vapid, and afterwards sour. The peculiar construction of my new-invented cock, and its apparatus, is calculated to prevent this evil, for it effectually shuts off all communication with the atmospheric air, except when the fluid is actually running into or out of the vessel, and in some cases the atmosphere may be entirely excluded, and only the gas of the peculiar fluid, or any other gas which may be desirable, admitted. And from the property which my cock has of permitting air and water to pass through it at the same time, I call it the Hydropneumatic Cock. One of its applications, as well as the construction of the cock itself, and its appendages, is shewn at Fig. 1, (Plate III.) in which A represents a longitudinal section of a common beer, wine, or other cask, or any vessel for containing fluids. B, a section of my hydropneumatic cock, driven into a hole in the end, or otherwise affixed to the lower part of the cask or vessel, by any of the common processes by which cocks are usually attached to vessels. C, the air pipe or tube, which in this example is external, or without the cask, and of which the end *e* is screwed, soldered, or otherwise attached to the cock, while the opposite end *d* terminates in a taper or conical end or ferrule *b*, through which the bore or cavity of the pipe *c* is continued, and which ferrule is to be firmly screwed, fixed, or driven into the top, or such other part of the cask as may be above the fluid, in such manner that its joints may be impervious to air. The cock itself has two passages through it, such as are known to workmen by the name of water-ways. The one, *ff*, Fig. 1, is such as is always made in common cocks for

for the liquor to run off; but in my improved cock I have another aperture, either below, above, or on one side of that by which the liquor escapes, and which need not be so large as the other end, which I call the air-way or passage, and this must pass through the exterior part of the cock as well as through the ground part of the plug or key, in the same manner that the water-way does, so that when either of these apertures is closed, by turning the key a quarter round, the other aperture will be closed also, as will be evident by the figure. This air passage may be perfectly straight, and its orifice end in a bush or knob of metal, upon that part of the cock which is least in the way, or it may be made to turn up in a perpendicular or other direction, as indicated in the figure at *e*, but in any case it must be united, either by screws, solder, cement, or other means well known to workmen, to an air-tight tube, which should be as large as the air passage through the cock, and should be flexible, so that it may be adapted to casks or vessels of different dimensions, as shewn at *e C d* in the same figure. I find annealed copper or small lead pipe answer best for this purpose; the upper end of this pipe, or that which is farthest from the cock, must be introduced into the upper part of the cask or other vessel, and this can easily be effected by soldering, or otherwise fixing on to it a ferrule or vent-peg, of harder metal, which is perforated with an air passage, so as to form a continuation of the air pipe, as shewn at *d b*, and as the outside of this ferrule is turned in a slightly tapering or conical form, it can be driven into a hole previously bored to receive it, or it may be screwed into or on to the hole, or fixed in any other manner which will render it air-tight. It is therefore evident, that any liquor which is contained in a vessel fitted up as aforesaid will be most completely cut off

from all communication with the atmosphere, except at that period of time when it is drawing off, for when the cock is in the position shewn in the figure the liquor will run off by the passage *f f*, while an equal quantity of air will pass by the other orifice *g* up the pipe *e* C *d*, and through the ferrule or vent-peg *b*, to supply the place of the discharged liquor; but so soon as the cock is shut, by turning it a quarter round, the air passage will also be closed, and no further quantity of air can either enter or escape.

The above description contains the whole of my principle, though its application may be varied in many ways, to suit the circumstances or situations in which it may be placed; thus where an external air pipe might be in the way, and would be liable to injury, as in the large vats used by brewers, distillers, and others, I place that pipe within the vessel, and as the pipe in this case is protected, it may be made of such metal as will not be affected by the liquor in which it is immersed, or it may be made even of wood, glass, leather kept open by a skeleton, or any other material which may be best suited to the purpose, all that is necessary being, that it should be impervious to air, or the surrounding liquid, that its top should be above the surface of that liquid, and that its bottom end should be closely screwed, or otherwise attached, to that part of the air passage of the cock which enters the vessel.

This disposition is shewn at Fig. 2, which represents a section of a close vat, with my improved cock and air vent attached to it. In this figure *b b* represents the liquor passage through the cock, and *a* the air passage, also passing through it, *c d* is the air tube, terminating at *d*, over which a screw cap may be placed, as at *e*, for the purpose of clearing out the air tube, should it at any time

time become foul. This vat may be filled through the liquor aperture of the cock *b*, an application which is recommended to brewers in particular, who find great advantage from starting in and near the bottom of their vats, or it may be filled at the top by an open aperture, or by a hose and screw cap, in which case the air must be permitted to escape, by taking off the other screw cap placed over the air pipe for getting at it; or without taking this last cap off the air may be suffered to escape down the air pipe, and through the cock by a side aperture or groove in the pin of the cock, as may be seen at *g*, in Fig. 3, which is a plan or top view of the same, or by the dotted space at *h*, in Fig. 2, which represents it in front view. While the vessel is filling or starting in at the bottom, the liquor passage *b*, Fig. 2, must of course be open, and at this time the air passage *a c*, which is immediately over and parallel to *b*, is also open, and the air can blow off at *a*; but if the vessel is to be filled from the top while closed, the liquor passage *b* must be shut, by which the air passage *a c* will also be shut, and its end next *a*, Fig. 3, will be brought to that part of the barrel of the cock marked *f*, but by this motion the side groove or aperture *g* is brought to coincide with the air communication *c*, leading to the inside of the vessel, by which the air can again blow off, while, if the cock is shut, by turning it in a contrary direction, so as to bring *g* to *a*, both the communications will be effectually stopped. Another process for opening the air communication, while the liquor way is shut, will be described hereafter.

Fig. 4 is a section of my improved cock and air vents, as applied to vats or vessels, in which it may be necessary to completely exclude the atmospheric air, and to preserve any gas or air which the liquor may generate upon itself, or for the purpose of exposing the surface of

of the fluid to any other particular gas or air as may be desirable. In this arrangement A, Fig. 4, is a section of the store vat, in which the liquor to be preserved is placed, and to which I apply my improved cock and apparatus either externally, as in the figure at *f*, its application being similar to that represented in Fig. 1, or internally, as shewn at Fig. 2. C is the under-back, which first contains the fluid. B a starting-pump, by which the vessel A can at any time be filled from C, whenever the common cock in the connecting pipe at *e* is opened. D a gasometer, and *g*, *i*, *g*, an air pipe, passing from above the water or other fluid in the gasometer either through the bottom of the vessel A or on its outside, but terminating within the vessel A, close to its top, so that no liquor it may at any time contain can run down the pipe *g*, *i*, *g*. For this disposition of apparatus I make use of my improved cock, with a double external air-way, as shewn in the sections Figs. 5 and 6; in which last figure it will be seen that the air-way does not pass through the pin or key of the cock, but terminates at the inside of the body or barrel, where it is bored or ground. The pin or key is similar to that of other cocks, but has two grooves or cavities cut into one, directly over the water-way, but not communicating with it, as seen at *c*, Fig. 6, the other cut on the blank side of the pin or key at right angles to the first, as at *d*, and both of them opening to the atmosphere at their upper ends, above the barrel of the cock. In Figs. 5 and 6, *a*, *b*, is the barrel of the cock, and *c*, *d*, *e*, *f*, the pin or key. The water-way through the cock is seen by the dotted lines *g*, *h*, while *c*, *d*, shews the two grooves or cavities for the passage of air, and *i* is the termination of the air pipe leading into the interior of the vessel; as the cock now stands any liquid would run out from the water-way *g*, *h*, while air would

would pass down and along *i*, to supply its place. If now I turn the cock a quarter round, so as to bring *d* to *i*, the water-way will be shut, but the air communication will still be open down *d*, and through *i*, so that although no fluid can run out, yet air can pass either in or out of the vessel. Upon turning the pin or key a quarter more round, *c*, in Fig. 5, will be carried to *e*, and *d* to *f*, so that the water-way will be again open, but without any air communication, for now *i* has no groove or cavity against it, and the air (if any is to be supplied to the vessel) must come from another source. On turning the cock a quarter further the grooves *c d* will be at *e d*, and consequently not only the water but the air communication will now be both completely cut off, and hence this cock is capable of producing every effect which is necessary in the use of the apparatus shewn at Fig. 4. If, for instance, I wish to fill and use the back or vessel A, as if it were not connected with the gasometer D, the cock at *i* must be shut, and my improved cock at *o* so placed that its water-way may be shut, while its air passage at *n* is open. Having opened the common cock *e*, and set the starting pump B to work, I can fill A with liquor, while the air will escape through *m* and *n*, and I then turn the cock *o*, so as to close both its passages. To draw off with atmospheric air I turn *f*, till the water-way and air-passage at *n* are both open; and now, while the fluid runs off at *o*, the air will enter at *n* and *m*. If I wish to use any air or gas which may be in the gasometer D instead of atmospheric air, I open the common cock *i*, and place my improved cock, by turning *f*, in such situation, that while its water-way is open the air passage *n* may be shut, and now whatever air gets into the vessel must be supplied from the gasometer through the air pipe *g*, *i*, *g*; and in order not to waste any gas which

which may be in the gasometer or vessel A when all its liquid is exhausted, I shut both passages of my improved cock *o*, and upon charging A with liquor, by working the pump B, any air or gas which may previously be in A will be forced along the air pipe *g*, *i*, *g*, into the gasometer, where, if it is too abundant for the contents of the gasometer, it will escape into the open air by the waste pipe *h*, and in the same manner any number of vats or vessels may be filled or drawn off by air tubes communicating with the gasometer, and a general main communicating with the drawing off cocks.

For the sake of producing a more perfect and air-tight closure in those vessels to which my improved apparatus may be applied, I have introduced screw caps instead of bungs to the upper part of the vessels in the annexed drawing; and small safety valves, opening outwards, should also be applied where the contained liquors are at all liable to ferment or produce gas. But I beg to state, that I do not claim or consider either of these, or the casks, gasometers or pumps, which I have been under the necessity of mentioning, to shew the application and utility of my invention, as any part of it, to the making, vending, putting up, or use of which I claim any exclusive right or privilege under my aforesaid patent, which I declare to extend only to my hydropneumatic cock, with its air pipes and appurtenances, as herein before particularly described, and to such modification of parts and principles as will cause the air-vent or cock to open and shut simultaneously with the drawing-off cock, and without a separate application of motion. And I declare that my said improved cock may be made of any metal or metals, or of any material that will answer the same purpose, and of such dimensions and proportions as are commonly made use of for cocks of the ordinary description.

In witness whereof, &c.

Specification

Specification of the Patent granted to GEORGE MONTAGUE HIGGINSON, *of Bovey Tracy, Chudleigh, Lieutenant in the Navy; for certain Improvements in Locks.*

Dated February 1, 1817.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said George Montague Higginson do hereby declare that the nature of my said invention is described by the annexed drawings, and the description, as follows; that is to say: My improvements in the construction of locks of various sorts, applicable to fastenings, consist in the adoption of a cylindrical roller, in a particular and novel manner, attached so as to prevent the introduction of picklocks for opening the works, and is described by the accompanying drawings and following description.

Fig. 1, (Plate V.) represents the interior of the works of a lock, differing little, if any, from those of common construction.

Fig. 2 is the cap-plate, for covering the works as usual.

Fig. 3 is a representation of the external part of a cylindric box, to be attached to or upon the cap-plate, as seen by the dotted lines, Fig. 2, the key-hole of the box being reversed to that of the cap plate.

Fig. 4 is a roller, to be placed within the cylindrical box, with a slight spring, only for the purpose of tightening it within the box. The object of this roller, which revolves, (by turning the key,) is to cover the key-hole from the introduction of a pick-lock; for when the key is out of the lock this roller prevents all communication

with the key-hole, and consequently with the interior, until by its revolution the aperture for the key to pass is brought opposite to the key-hole of the cap-plate.

Thus it is evident my apparatus is an additional security to locks of the common construction, and does not so far alter the works of the interior, or deviate from the present arrangement of the interior of locks, but in the adoption and action of the cylindrical roller to the purpose of preventing such locks from being picked.

Another mode which I adopt for the purpose of preventing the possibility of picking the lock is described in Fig. 5, and consists, first, of a cylindrical piece *a*, sliding upon the circular ward, and closing or preventing all access to the works from the centre, having an aperture for the introduction of the key, by which the cylindrical piece is carried round, and upon withdrawing the key the aperture remains opposite to the hole of the cap-plate, or by the adoption of a revolving cross, fitting to and acting within the wards, so as to exclude all passage to the inner works represented at *a*, Fig. 6. To preclude the introduction of a pick-lock through the outer channel of the wards I place a projecting piece marked *b*, bearing against the circular ward, and supported by a spring lever, to admit the passage of the key. This piece *b*, if attempted to be raised by a pick-lock, or any other force, would recede into the notch *c*, and prevent the bolt from returning; or, instead of attaching this projecting piece to a spring, it may be suspended as *b*, Fig. 6, against which a spring acts for the same purpose as the former, and by its receding into the notch, as before described, locks or confines the bolt.

In witness whereof, &c.

OBSER-

Mr. Higginson's Patent

Fig. 1.

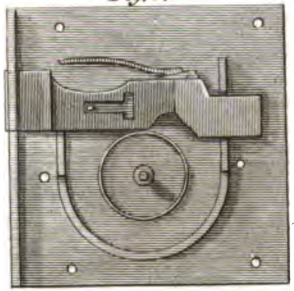


Fig. 2.

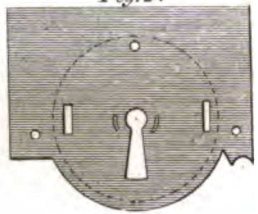


Fig. 3.

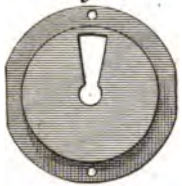


Fig. 4.

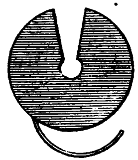


Fig. 5.

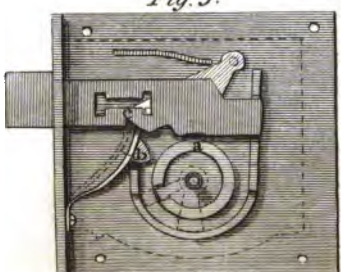


Fig. 6.

The Rev.d Jas. Bremner's Day Telegraph

Fig. 1.

Fig. 2.

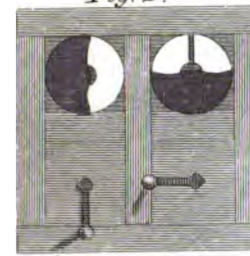


Fig. 3.

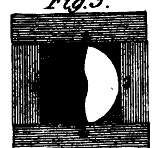


Fig. 4.

Fig. 5.

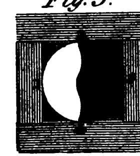
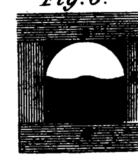


Fig. 6.



Observations by the Patentee.

The cylindric roller and box may be applied to locks having a pin, in common use. The key-hole of the cap-plate may be made to vary in sise and form correspondent with the key, varying from the external key-hole that is in the roller and box. The cap-plate key-hole, and the works of the lock being secure from inspection, prevents the making of a false key, but from an impression of the original; this I do not pretend to render nugatory, nor do I believe it has yet been discovered, but the impossibility of picking the lock will be obvious to every one.

My object has been security against pick-locks, security from inspection of the works, or proper key-hole of the lock,—combining strength, simplicity, and cheapness.

Specification of the Patent granted to John Stubbs Jorden, *of Birmingham, in the County of Warwick, Copper Window Frame Maker; for a Method of Glazing Hot-Houses, Green-Houses, and all Horticultural Buildings.* Dated August 20, 1811.

With a Wood Engraving.

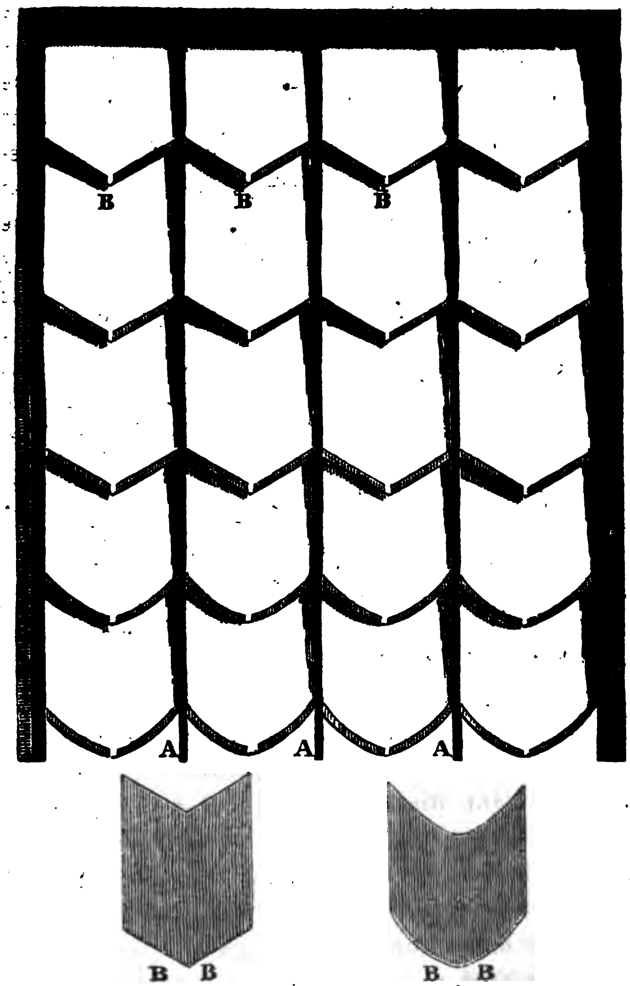
To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said John Stubbs Jordan do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described in manner following manner; that is to say: I denominate my invention perforated shield glazing, by uniting pales of crown or common glass, previously cut out in the shape

of shields, (as shewn by the drawing in the margin hereof,) of the same equal size and shape, or parts of the same, as the purpose may require, which I cause to lap over each other in the manner of fish-scales, in frames A A A, made of copper, brass, tin, iron, or any other metals, or mixture of metals, proper for the purpose, or in frames made of wood, or wood and metal connected. And in lieu of common putty, to unite the panes A, B B B, I use a cement, on which the action of air, water, or frost, has but little if any power, leaving an aperture at the base of the shield, so that the condensed steam or water may pass off, which in the common manner of glazing falls upon the plants, to their great injury. By this shape and method of shield glazing the lap-over of the glass becomes an inclined line, dexter and sinister, as at B B B, and the cement being furrowed out on the under side, forms a channel for the condensed water to escape without freezing, between the laps of the glass, as is the case in the common method of glazing, which is very destructive to the glass, and incurs a very heavy annual expence on repairs.

In witness whereof, &c.

Mr.

Mr. Jorden's Frame for Glazing Hot-Houses, &c.



Specification

Specification of the Patent granted to Robert Ford, *late of Barbican, in the City of London, but now of Crouch End, in the Parish of Hornsey, and County of Middlesex, Chemist; for a Medicine for the Cure of Coughs, Colds, Asthmas, and Consumptions, which I denominate "Ford's Balsam of Horehound."*

Dated November 21, 1816.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said Robert Ford do hereby declare that the nature of my said invention, and in what manner the same is to be performed, are particularly described and ascertained as follows; that is to say: Take of the herb of horehound three pounds and a half, to which add three pounds and a half of liquorice root, and then add to the above a sufficient quantity of pure water, to infuse in a still for six days, (but the quantity of water must depend entirely on the nature of the horehound); then take of the infusion or extract sixteen pints, to which add twelve pints of spirit of wine, or the best French brandy. Of gum camphore add one ounce and a quarter, and of extract of Turkey opium one ounce; of benjamin one ounce; of dried squills two ounces; of oil of aniseed eight drachms; of clarified honey three pounds and a half; and let the same be digested together in a close cask or vessel for twenty-eight days. Greater or less quantities may be made if required, by increasing or diminishing the ingredients in the proportions above stated.

In witness whereof, &c.

On

On Mangold Wurzel.

In a Letter from Mr. THOMAS NEWBY, *of Cambridge, to the Editors.*

GENTLEMEN,

I READ in the Number of your Repertory for March, an extract of a letter sent from Dr. Lettsom to Dr. Duncan, respecting mangold wurzel; and as my name is there mentioned in a letter sent from Sir Mordaunt Martin, of Burnham, Norfolk, to the former gentleman, I beg the indulgence of a few observations on the subject, for without an explanation the reader might suppose I was at the time charging an exorbitant price for my mangold wurzel seed. In the year 1813 this invaluable vegetable was almost unknown in this county and isle, and I pride myself with having had the honour of introducing it into cultivation and use. I obtained with difficulty some seed of the *new improved stock* of mangold wurzel, at a high price; and after paying the expenses of advertising, printing, and other concomitant expenses, I found the price I sold it at left me *minus*, although in so doing I was making a voluntary sacrifice, it was in order to introduce and recommend its general cultivation throughout the county and isle. From that period I have been a constant grower and seller of the seed of the *new improved stock*, and have had the satisfaction to learn that it is generally approved in most counties in England, and many parts of Scotland and Ireland, where I have sent the seed. What the stock and quality of Sir Mordaunt Martin's seed was, I am unable to say, and the price he chose to sell it at I have no business with, though the letter (now before me) which I had the honour of receiving from Sir Mordaunt, clearly evinces he gave the

the preference to my stock, and as the observations contained in the letter may tend to elucidate the *genuine improved stock* from the *spurious*, (for to the latter is mainly to be attributed the failure of crops, and the slow advance it has made in cultivation,) I beg to subjoin it.

"Sir, *Burnham, Norfolk, March* 16, 1815.

"I have been an attentive cultivator of mangold wurzel from its first introduction, and began by sowing seeds from such plants as grew most into the ground, in hopes of their resisting the frosts, but was soon convinced of my error. A friend sent me a few seeds from Brussels, they produced plants with very small tops, and growing so much out of the ground as to bend with their own weight. I last year bought a pound of your seed, and disposed of some of it in small packets, as widely as I could, that if it should prove superior to mine you might have your due credit; the rest I sowed in drills, between some what Dr. Lettsom sent me and my own; yours was certainly the largest, and produced the most foliage, and were so much the clearest from fangs that I shall continue to save the seed. I am about planting out every well-formed root I can spare for seed, to protect them from hares. I have formed a small island in a marsh; but I find the soil (which has chiefly been an old sea bank) to be so much too stiff, that I shall only try a small part of it this season, which may give me the benefit of a change of soil for my own future use. The chief of the produce of my roots in the upland I shall allot for sale: for which purpose I shall get a friend in London to enquire the price at different shops, and then advertize it in 'The Farmer's Journal,' at the average of their collective prices. This year I have barely seed enough left for my own use, having supplied a few friends,

 and

and sold the rest between Messrs. Mackies, of Norwich, and Mr. Mason, of Fleet-street, London.

I am, Sir,

To Mr. Thomas Newby,
Trumpington-street,
Cambridge.

Your obedient servant,
MORDAUNT MARTIN."

Surely the ghost of the Abbé de Commerell would be indignant should mangold wurzel be in any way now depreciated: and it would be an act of injustice to the cause of agriculture not to mention, that, on the contrary, it is becoming a favourite in husbandry, and that the silly prejudice which originated in Norfolk, in the year 1814, is subsided. For the backwardness of all the grasses, and the want of cattle-food in this inclement spring, has opened the eyes of many farmers, who had hitherto been blind to their own interest. Those who were wise enough to cultivate mangold wurzel, and with judicious management, preserved it for spring feeding, their dairies have had a plenty, while others were starving.

Yours, &c.

THOMAS NEWBY.

*** Owing to an accident this communication was omitted in our last Number.

Observations on the Phenomenon observed at Bridlington Harbour. By Mr. JAMES WATT, *of Glasgow, M. D. Communicated by the Author.*

GENTLEMEN,

IN your Number for May, you inserted my attempt to explain the phenomena of the fountain at Bridlington Harbour, which flows and ebbs with the tide, and rises

 above

above it. I supposed a mass of air, situated between the two, to be the medium of communicating the pressure from the tide to the reservoir of fresh water. Whether the phenomena be really owing to such a cause I shall not now farther inquire. I suggested that the same principle might be improved, and the alternations of the tide employed to raise water for useful purposes, *viz.* by forming an artificial cavern, to be alternately filled with air and with the tide, and having a tube leading from it to a reservoir of fresh water; and all to be air-tight.

It is obvious, that the same principle may be employed in raising a quantity of water above its level wherever there is any fall of water. Water will run along its level into a vessel capable of being rendered air-tight. From this vessel a tube may arise to a vessel placed higher, and another tube may descend into a vessel set under the pressure of the fall. The water, entering the lower vessel with force, would expel the air from it, by the ascending tube, into the more elevated vessel, where it would press on the surface of the fluid in that vessel, and raise it, by the tube, to the higher level, or where wanted. It is plain, that in such a process the tubes should reach from near the bottom of the inferior vessel to the bottom of the superior, to carry up the water; and, from the top of the inferior, to nearly the top of the superior, to convey the air for pressure. The effect may be otherwise possible, but much less convenient.

To apply the Principle.—Let it be supposed that a building of five stories, such as the Royal Infirmary, Glasgow, has water supplied from a reservoir, which is elevated, only to supply the three inferior stories, whilst the two superior stories are not so supplied. These two stories might be supplied from the second, third, or lowest, by the discharge of the water into the sunk story.

Supposing

Supposing a vessel or vessels, on the third floor, filled with water, and furnished with tubes, rising from near their bottoms within, into suitable vessels on the fourth and fifth floors, to raise the water, and with tubes descending from near their tops within into the tops of the vessels in the sunk story, to transmit air; then let the water be brought in from the reservoir to fill three lower vessels. This fluid will force the air out of those lower vessels up the tubes into the vessels on the third floor; and this air, pressing on the water in these vessels, will force a proper quantity of it upwards into the vessels on the superior floors.

It is evident, that these last named vessels must be open to the atmosphere during the process. At other times the other vessels may be opened to the atmosphere, and then each will afford supply of water to the floor where it is placed.

Your hydraulic readers will see, that the above proposals are only so many modes of applying the principle of Hiero's fountain. They will see also, that the same principle will solve the problem of constructing a lamp with its fountain directly under the flame, so as not to impede the lighting of the apartment or table by its shadow. I believe the patent moon lamps were formed on such a construction. I have, however, lately seen on this principle a lamp of a much more simple and elegant structure, and less liable to accidents.

Yours, &c.

JAMES WATT.

Hints on the Processes of British Wine-making.

By Dr. MACCULLOCH, *Woolwich.*

(Concluded from Page 118.)

IT is true, that the produce is then without flavour, or nearly so, but this is by much the most tolerable fault in domestic wines, whose leading defect is almost invariably a disagreeable taste. Various proportions of fruit and sugar are used by different persons; but the most common consist of three pounds sugar and four of fruit, to eight pounds of water. Here the proportion of fruit is too small compared to that of the sugar, and the fermentation is consequently in general so imperfect as to leave the wine disagreeably sweet. At the same time, the proportion of sugar is such, as to render the wine stronger than the strongest wines of Champagne. If, therefore, this wine is to be amended in composition, it is either by reducing the sugar, if we are contented with a weaker wine, or by increasing the fruit, if we are desirous of retaining the greatest strength. In managing the fermentation to a constant and successful result, the rules laid down as practised for Champagne wine are strictly applicable in the present case; and with these precautions and practices carefully attended to, the produce of the gooseberry will be invariably successful. I may also add, that it is perfectly durable; as much so as Champagne wines of corresponding quality, provided equal care be taken in the bottling, the cellarage, and other management; all of them, circumstances in which our domestic fabricators are too apt to fail, thinking that when they have mixed together a portion of sugar and fruit their labour is finished, and that the rest may be trusted to

chance.

chance. They should consider, on the contrary, that it has but then commenced.

From the gooseberry in a ripe state wines may also be made, for which no rules are required, as they are precisely conformable to those before laid down. But the produce of the ripe fruit is commonly ill flavoured, and, whether sweet or dry, is scarcely to be rendered palatable, unless perhaps by a most careful exclusion of the husks.

The three varieties of the *currant* are perhaps even better known, and more in use as ingredients in wine-making than the gooseberry; and as the produce of each is attended with some difference, I shall notice them separately. Both from the *white* and *red* sort wines are made which differ principally in colour, but also very slightly in flavour, though the flavour of neither is very characteristic. I have ascertained, by repeated trials, that a principal defect in these wines, as commonly fabricated, arises from the sparing proportion in which the fruit is used, which otherwise contains a sufficient quantity of natural acid, as well as extractive matter, to ensure a perfect fermentation, if properly managed. Partly from this cause, as well as from the imperfect management of the fermentation, these wines are usually made sweet. They are also, not uncommonly, nauseous, as well from the combination of a natural bad flavour with this mawkish sweetness, as from the other improprieties of management before noticed. By increasing the quantity of fruit, (which is generally proportioned like that for gooseberry wine,) and by avoiding the use of the husks, the flavour is materially improved, and the quality of the wine further ameliorated, the fabricator at the same time acquiring the power of making his wine sweet or dry; whereas, according to the present mode, he is generally

generally unable to produce the latter variety. The natural tendency of this fruit is to form a wine analogous to the lighter white wines of the grape, and it is a rational object to follow the tendency which is pointed out by the nature of the fruit. I have also reason to think, that much advantage would result from the use of tartar in this case, by which, among other defects, the ammoniacal taste so common in this wine seems to be prevented. The proportion of tartar need not be specified, as it has been mentioned before, and that of sugar is to be regulated by the principles already laid down. With careful management, wines are thus produced from currants, not easily to be distinguished from the Colares of Portugal, which, although not in the first class of wines, is certainly superior to most of our domestic manufactures. A considerable improvement may be made in the fabric of all those wines produced from fruits of which the flavour is either bad, or which possess no flavour at all; and this is by boiling the fruit previously to fermentation,—a practice which I have caused to be adopted in currant wines with decided success. From this treatment many tasteless fruits acquire a flavour, as is well known, and many bad flavours are converted into agreeable ones. In no case, perhaps, is this more remarkable than in the *black currant*, which, harsh, and comparatively insipid in its natural state, acquires, by boiling, a powerful, and, to most persons, a highly-agreeable flavour.

In making wine from this variety of currant, the effects of this process are very remarkable; the produce of the raw fruit being scarcely distinguished by any particular property from the herd of domestic wines, while that of the boiled fruit may with careful management be brought to resemble some of the best of the sweet Cape wines.

wines. In the white and red currant, the same precaution has been attended with results equally successful, though not marked by a contrast so decided. The same varieties of proportion are admissible in this case, as in the others lately mentioned, and I need not therefore detail receipts which are to be found in the hands of every one. To what extent the practice of boiling may be tried with advantage I do not know; but I may venture to point it out as an improvement worthy of further investigation.

Although the dried *raisin* cannot be considered as a domestic fruit, yet as, like the orange and lemon, it is largely used in the manafacture of domestic wines, I may here take notice of it. The history of the art of wine-making, in the countries where the vine is an object of common cultivation, has already shown, that the grape is in many places used for this purpose in a state, if not actually that of raisins, yet approaching towards it. Thus the wines of Cyprus and Tokay, among many others, are produced from grapes which have undergone a partial desiccation. Analogy, therefore, would lead us to expect, that wines of good quality might in this country also be produced by using the dried grapes for that purpose, as they are imported in the state of raisins. Yet the success which has followed the innumerable attempts to make raisin wine has by no mesns justified that expectation, although the expensive scale on which the manufacture has been, and is still, carried on by the makers of *sweets*, should long ere this have brought it to perfection. It is not apparent to what causes this failure is owing, nor is it possible, without repeated and expensive experiments, to investigate the process in such a way as to lay the foundation of a more successful practice. But an examination of the processes in common use may perhaps

perhaps suggest some hints conducive to a more rational and improved mode of proceeding.

In manufacturing this wine on the large scale, whether for the purpose of open sale as *sweets*, or for the fraudulent imitation and adulteration of foreign wines, a quantity of raisins varying from two as far as seven pounds to the gallon of water is used, together with a proportion of common clayed sugar or molasses, reaching from half a pound to three or four pounds. In many cases from four to six pounds of crude tartar *per* cwt. is added. Yeast is not in general employed to assist the fermentation, nor should it ever be used, for the reasons already assigned. It is asserted, that the product of this process is a pure and flavourless vinous fluid, capable of receiving any flavour which may be required, and thus, of imitating many wines of foreign growth. Whatever the case may be when such fluids are used for the fraudulent purposes above mentioned, the wines themselves, which are common in the market, and which are confessedly made in this way, are almost always nauseous, whether sweet or dry, and however they may be called by the various names of Lunel, Teneriffe, Sherry, or Canary, they have all the same disagreeable and over-powering flavour. It is probable, that a great part of this peculiarity is owing to the quality of the sugar employed; but it is also to be suspected, that the complete drying of the grape developes in that fruit, some obnoxious taste which is communicated to the produce. I cannot pretend to throw any more particular light on the subject; but should recommend to those who are inclined to make trial of raisins, a nice attention to all the circumstances in the mode of fermentation and management, which have already been detailed. If these fail to produce the desired effect of purity in the wine, we shall then be entitled

titled to consider the manufacture of raisin wine as incapable of further improvement.

I have thus given such a brief general view of the several varieties of wines which may be made in this country, as will be sufficient to render more intelligible the principles and practices on which they are founded, without which all attempts must either be futile, or must at least be regulated by chance, giving results which will seldom obey the previous intentions of the manufacturer. The reader, who shall be at the pains of comparing what has now been said on our domestic fruits, with the more detailed theoretical and practical views laid down in the first part of this Essay, will easily form for himself a correct set of rules of practice. It is in vain to say, that correct rules can be laid down in an abstract form, and capable of easy application, or that the practice may be rendered perfect, independently of the theory. Circumstances of a most evanescent nature, and, although important, often unheeded, necessarily interfere with all positive rules, and new cases are continually occurring, for which no previous rules can be given. He who is acquainted with the theory of the art, is always in possession of that light which will alone guide him through the intricacy of new cases, and of unexpected results. With the small apparatus of a theory, he has it in his power to do that without difficulty, and without labour, which he who is destitute of theory can seldom execute, even with the cumbrous and generally unintelligible apparatus of a set of fixed canons.

In making wines, as it is to be supposed that the fabricator has previously adopted some general views regarding the species of wine he proposes to make, and does not intend to trust the result to chance, he should consider of what kind he wishes his wine to be, or which of

the several modifications of foreign wines he means it to resemble. By these considerations he must be guided in his practice; and, to assist his views, I will briefly enumerate the several varieties which it is in his power to imitate, in their general and fundamental qualities.

The first and simple class are the *sweet wines*, of which the fermentation is incomplete. This incompleteness may arise from two sources, either the disproportion of sugar in the *must*, or the artificial means adopted for suspending the fermentation, and which have been already described. It is to this class that our native wines bear the greatest resemblance; a resemblance indeed so general, that few makers of this article appear to possess sufficient knowledge of the art, to enable themselves to steer clear of that which may be fairly called the radical defect of domestic wines. But a consideration of the causes of sweetness in wines, already amply laid down, and of the modes in which it may be avoided, will, I trust, enable the manufacturer to choose, whether his wine shall be sweet or not,—a choice which, in the present mode of management, is rarely left to him.

The next leading description of wines is that to which, either in a state of sweetness or comparative dryness, is super-added the effervescence or uncorking, which produces *briskness* or *sparkling*. The causes of this phenomenon, and the mode of ensuring, preserving, and regulating it, have been also fully detailed; and it has been seen how it is compatible, either with a very considerable sweetness, or with a limited degree of the same property. As this modification is also esteemed among the made wines, it is desirable that an accurate knowledge of the method of producing it should be attained, since it is frequently missed, in consequence of negligence or ignorance in the conduct of the process. It is from gooseberries,

berries, almost solely, that this variety has in this country been made; but it is by no means limited to that fruit, since, with due attention to the period of maturity, and with careful management, it may be equally well made from any other fruit. I must not, however, quit this subject, without cautioning the operator against a bad expedient, to which recourse has been had for producing the effect of sparkling. It is the introduction of a small portion of carbonate of potash or soda into the bottle immediately before corking it. The consequence of this is, doubtless, a disengagement of gas at the moment of pouring out. But the gas speedily flies off, almost before the wine can be drunk, since it exists but in a loose state of combination, and in but small quantity. Nor does it communicate to the palate that agreeable and lively sensation which follows from the disengagement of that carbonic gas, which is in a real state of combination with the wine. Moreover, the neutral salt formed by the alkali, with the natural acid of the wine, is always sensible to the taste; while at the same time the native acid of the wine, so essential to the composition of this fluid, is destroyed; not to mention the danger of this acid-taste being replaced by an alkaline one, from an over-dose of that ingredient.

The third variety of wine is that of which Hock, Grave, and Rhenish, may be taken as examples. In these the saccharine principle is entirely overcome by a complete fermentation, while their after-change is prevented by a careful application of those processes laid down for the preservation of the wines of this class. Makers of domestic wines have rarely succeeded in imitating these wines. The reasons are obviously two fold, the great disproportion of the sugar to the subsequent fermentation in the first instance, and that want of the after-

 management,

management, the neglect of which soon consigns these wines to the vinegar cask, if chance should even at first have produced success. I may venture to point out the imitation of these wines, from my own experience, not only as readily attainable, but as among the very best of those which can be made from domestic fruits. It is evident, from what has been already said, that the relative proportions of the fruit and sugar in most common use, must be materially altered, and that the fermentation must be conducted in a much more perfect manner, before we can hope to produce wines of this character. It is equally evident, that the processes of racking, sulphuring, and fining, must be practised with great assiduity, to preserve these wines after we have succeeded in making them.

The last class of wines are those which are both dry in their quality and strong in their nature. Such are Madeira, Sherry, and the stronger wines. The theory of these is equally apparent; and it is certain, that with due attention to the fermentation, wines of this strength and quality may be made without the addition of brandy. Yet the operator has it in his power, by means of this ingredient, under the restrictions already laid down, to produce wines of any required degree of strength; and I trust, that with the light which I have thus endeavoured to derive from the legitimate processes of wine-making, I have established a beacon to guide him through the trackless route of his hitherto conjectural art.

British Grape Wine.

I have chosen to throw into a separate section of this Essay, the remarks which I had to offer on the art of making wine from *Grapes* of British growth, on account of the greater importance of this part of the subject, and also

also on account of the neglect which seems to have attended that branch of domestic wine-making. I hope to make it appear that wines, not to be distinguished from those of foreign growth, can in this country be made from grapes, and at a moderate expense: and that the success of this process is not at all affected by the uncertainty which attends the ripening of the grape in our climate. It is not too strong an expression to say, that the use of this fruit is calculated to supersede that of all others, and that it is in fact almost the only species of domestic wine which is worthy of serious attention.

The Essays of Mr. Pegge, in the Archæologia, with the subsequent controversies which originated in the opposition of Mr. Daines Barrington, have established beyond doubt the fact, that vineyards were cultivated in the monasteries of Britain, for the purpose of making wine. It appears, however, by the records of Ely, that the grapes did not ripen every year, but that the vineyards, as might be expected in this climate, were subject to occasional failures. We have, therefore, no reason to conclude, from the establishment of this fact, that our climate has undergone any material and steady alteration, — a supposition which is often hazarded by discontented horticulturists without sufficient grounds, and apparently from no other cause than that ill humour which delights, as it has at all times delighted, in praising the past at the expense of the present.

The physical history of Europe, indeed, shews, that its climate has for many centuries, been in a state of amelioration. Whether this amelioration may not now have attained its *maximum*, is another consideration. If it has so done, it is certainly within a period comparatively very recent. As far as we are capable of judging, no material variation in the success of our horticultural speculations

speculations has occurred for the worse, provided we choose periods of sufficient length to admit of an average result. Occasional seasons of peculiar severity, or unusual irregularity, can afford no ground for judgment. The suppression of the monasteries, the great and splendid changes which our whole system of agriculture has undergone since those days, the increase of trade, the more economical division and application of capital to objects of commerce, and to those of domestic manufacture, the multiplied demands which wealth and prosperity have made on the consumption of wine, and the increased discrimination and taste which this has produced, have combined together to change materially both the objects of commerce and cultivation, and have jointly operated in producing the decay of this art, if (as is by no means proved), it was ever actually practised to any great extent. But this question does not concern our present purpose. It is sufficient to prove, what in fact there is no reason whatever to doubt, that the grape, as it is or may be cultivated in England, is capable of making wine; whether with advantage, considered in an agricultural view, and with what advantage, must depend on other considerations, into which I need not now enter. However diminished this practice is in modern times, it is by no means extinct. The cottagers in Sussex are in the habit of making wine almost annually from the produce of vines trained on the walls of their houses. Many individuals, through various parts of the Southern Counties, and even as far North as Derbyshire, practise the same with success. But the experiment is well known to have been made for many years on a large scale, and with complete results, at Pain's Hill, by the Honourable Charles Hamilton, in a situation, with respect to soil and exposure, of which parallel instances

are

are to be found almost every where throughout the country, and produced from land of no value whatever for the ordinary purposes of agriculture.

It is true, that the uncertainty of this climate will sometimes prevent the grapes from ripening: but this case is not without remedy.

Of the numerous varieties of grapes, it is well known to gardeners, that some are much more forward than others, and ripen their fruit at least a month earlier. It is obviously necessary to select for our purposes those which are the most early, if it is our desire to produce in every season a ripe crop. Of these, the Auvernat, the Miller, the White Muscadine, the White and Black Chasselas, the Black Sweet-water, and the Black Hamburgh, are among those which ripen earliest, and with the greatest certainty. But I need not enter on this part of the subject, since it is fully known to gardeners.

It is more important to consider, what improvements may yet be made in the naturalization of this foreign plant, and whether care and attention may not in time produce new varieties, still more hardy, and capable of ripening, with the same certainty as the currant or gooseberry. In a paper read before the Caledonian Horticultural Society, I slightly alluded to this subject, and pointed out the methods to be followed in naturalizing exotic plants in general *. The observations of all gardeners have long since shewn, that a tender exotic, rarely, if ever, becomes habituated to a climate, if it be propagated by layers, grafts, or cuttings; since the new plant is always perfectly identical in all its habits and properties with the parent, of which indeed it forms a part. But a material change in the constitution of plants

* Published in vol. I. p. 284, of the Memoirs of this Society.

is produced by sowing the seeds, and the seedlings are invariably more hardy than the plant from which they were derived. I quoted in that paper some observations made by Sir Joseph Banks, on the naturalization of *Zizania aquatica*, and related an instance still more remarkable, of a similar effect produced on *Canna indica*, a native of the West India islands, by successive sowing of the seeds in Guernsey. From these two remarkable facts, and perfect examples of success, as well as from innumerable more imperfect trials, it seems clearly established, that any plant may be naturalized to this climate, provided its seeds can be made to grow in succession. This, however theoretically true, is obviously attended with much practical trouble, in consequence of the difficulty of descending equally, and for a given length of time, through a given range of temperature; a difficulty which would in fact, in most cases, be insuperable. But no such obstacle prevents the further naturalization of those which produce seeds already in our summer temperature, and which are not destroyed by our winter frosts. Among these the vine may be enumerated. To a certain extent it may indeed be considered as already naturalized, since it flowers every summer, and the winter frosts do not destroy it. So may the common laurel be looked upon as naturalized; yet a severe winter will kill this shrub, as a cold summer will prevent the vine from bringing its fruit to maturity. It is by a sedulous culture of seedling vines alone that we can hope to overcome this obstacle, and to produce varieties which shall ripen in all summers. For this purpose it is not sufficient to make trial of one or two successions of seedlings. Experience has shewn, that numerous generations in a direct descent from the parent are required for the production of this effect. What that number is has scarcely

yet been ascertained, except in the cases of the Zizania, and the Canna above quoted; but it probably varies according to the previous tenderness of the parent. In the vine, already considerably hardy, the object would probably be attained in a few generations. As I consider this object as one of prime importance, I venture to point it out to the serious attention of horticulturists, and as one which is likely to reward their labours. The production of new varieties will naturally follow these attempts, and by combining with them the process of impregnating the flowers with the *pollen* of different grapes, new and valuable ones may ultimately be produced. By the choice, therefore, originally, of proper varieties of the vine, and by such naturalization on these principles as we may be capable of producing, we shall have gained one great step in the art of making wine from grapes of British growth.

The next step is the choice of that soil, exposure, and method of treatment, which is adapted not only to the habits of the vine, but to that particular climate in which the cultivation is attempted. Our guide here must be the practice of those countries, whose climate most resembles our own; of certain parts of Germany and Hungary. An elevated situation, a southern exposure, shelter to the North and North-west, rocky and Southern precipices, are peculiarly adapted to the situation of a vineyard; so are gravelly and rocky soils; a circumstance in another view advantageous, since these soils are of very little value for common agricultural purposes. But I forbear to enter into details, which are to be found in many essays on gardening, and in others which have been written expressly on this subject.

It is the more direct object of this essay to shew that the making of good wine from grapes of British growth,

does by no means depend on their maturation, and that this is not a necessary circumstance. The process of making wine from grapes will be reduced to a much narrower question, if we can succeed in making it at all times, unchecked by seasons or accidents. A vineyard may thus be conducted with almost as little care as a gooseberry garden, with the certainty of a constant produce applicable to the purposes in view; and it will be in every one's power, in almost any situation. However precarious the ripening of the grape may be, its produce is not so. We are sure of an annual crop of grapes, but not of an annual crop of ripe ones.

It has been fully proved, by the facts and principles laid down in the first part of this essay, that a compound and artificial *must* can be fabricated from due mixtures of sugar, with the extractive matter and saline substances of fruits, capable of undergoing a regular fermentation, and of forming good and perfect wine. The case is as applicable to the grape as to the gooseberry. Long ago experiments were made in France, by several chemists, with green grapes and sugar, and with complete success. I have repeated these experiments, and varied them with the best effects. The produce has varied with the management, and the results of the trials have been wines resembling Champagne, Grave, Rhenish, and Moselle, and of qualities so perfect, that the best judges and wine-tasters have not been able to distinguish them from foreign wines. The grapes may be used in any state, however immature. When even but half-grown, and perfectly hard, they succeed completely. It is evident that wines made on this principle will be more expensive than when made from ripe grapes, as a sufficient quantity of sugar must be used to compensate for the deficiency of the natural sugar of the grape. But

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even then they are no more costly than currant or gooseberry wines, while at the same time their superiority is beyond all comparison. The hardest grapes will produce a wine of the strength of white Hermitage, with a proportion of three pounds of sugar to the gallon; and the expense will be trifling compared to the value of the produce.

It might be supposed that these wines would necessarily be devoid of flavour. But this is by no means the case, since all the specimens which were made under my direction were characterised by flavours, as genuine and decided, as those of the foreign wines to which they approximated. I have little doubt, that, under due management, on a large scale, and with sufficient age, wines of the Hock quality could equally well be produced here in the same way.

Many trials must yet be made before we can hope to appreciate the extent of our resources in this manufacture. It is more than probable, that different grapes, even in this immature state, would produce different wines; but these trials must be left to the efforts of individuals, and to the necessarily slow progress of experiment.

With regard to the management, it must be founded on the operations followed in the wine countries, and of which a sufficiently full account for all the purposes of practice has already been given. It is, in the first place, obvious, that the grapes should be suffered (from motives of economy) to remain on the vines while there is any hope of gaining an accession either of strength or sweetness. They should then be carefully separated from the stems; those which are mouldy or rotten being at the same time rejected. Some judgment will be required in proportioning the fruit to the water in the first instance,

and to the sugar in the second. I have before said, that the grape when ripe consists of sugar, combined with vegetable extractive matter, or the fermenting principle, and certain salts, besides the astringent and flavouring matter. As the colour is not developed in the immature grape, it need not be noticed here. But the proportions of these ingredients vary materially, according to the state of maturity of the fruit. As a great part of the saline and other constituents of the grape appear to be converted into sugar during the process of maturation; it is plain that, weight for weight, there will be more of the principles contained in the immature than in the mature fruit. To form, therefore, a *must* of such a quality as shall resemble the natural *must* of ripe fruit, it is necessary that water should be added to the immature juice, for the purpose of diluting, and thus diminishing the proportions of those saline matters, which would otherwise confer on the wine a degree of harshness difficult to overcome.

As it is impossible to give positive rules to meet the infinitely varying and undefinable degree of maturity, in which the grape must often be used, and as such rules would in fact but tend to mislead, I shall content myself with laying down some general principles, as I have done on former occasions, leaving the application to the ingenuity and observation of the operator.

If the object be to produce a wine which shall resemble Champagne, or the white wines of Bourdeaux, a small proportion of crude grape will be required. Grapes barely half grown require, for the production of wines of this class, to be used in the proportion of equality to water. If they are more grown, the proportion may be increased; if less, it may be diminished. If the intention be to make a wine resembling Hock, the proportion of

of grapes must be materially increased, and the wine at first harsh, austere, and not drinkable when new, will by a few years residence in the cask undergo that amelioration which time alone can give. To the proportions which I have described, varying quantities of sugar may be applied. A proportion of two pounds in the gallon of mixture will yield a very light wine, of no great durability, resembling (under the proper treatment) the inferior classes of Champagne wines, and under a different mode, a wine resembling Barsac, and the lighter of the Bourdeaux wines. An increase of the sugar to three pounds will yield a wine equal in strength to the best sorts of Champagne, or if fermented to dryness, to the strongest of the white wines of Bourdeaux. Larger doses of sugar will doubtless yield wines of different qualities; but of such proportions I cannot speak from experience. I may only caution the operator who shall undertake these trials, that larger quantities of sugar require larger proportions of fruit, if it be his intention to work the wine to dryness, as the quantity of fruit above mentioned is but barely sufficient to convert the proportion of three pounds above named. With regard to the durability of these wines, I may add, that I have kept them for seven years, and during all that time with evident improvement. I should consider them to be as little liable to destruction as foreign wines of the very best *fabrique*.

While on the subject of sugar, I may also say, that the general cause of failure in those wines which are made in this country from ripe grapes, is the deficiency of sugar, and that even these would be much improved by an addition of it. It is owing to this deficiency that these wines are perishable, and easily converted into vinegar, the natural *must* being too aqueous to produce a durable wine. The proportion of sugar need not be larger in these cases;

but,

but, as before remarked, no positive rules can be given for it, since it must vary with the maturity and saccharine quality of the fruit,—circumstances which differ in almost every season.

Two modes of management may be adopted with regard to the fruit, either subjecting the skins to the fermentation or not. In the first case, a greater degree of austerity will be the consequence; and the wine will consequently vary in its qualities. If the object be to make a wine resembling Champagne, the skins may be separated previously to the fermentation. If this manufacture be conducted on a large scale, the result of the second pressing may be reserved to make a distinct wine. If on a small one, it may either be mixed with the first, or rejected altogether.

The methods of conducting the fermentation, as well as all the after-management, need not be repeated here, as they are to be found in the beginning of this essay. From these the operator will be directed to the several sorts of wine he may wish to make. It is equally unnecessary to repeat, that wines produced in this way may be modified either in flavour or colour, by the several expedients already detailed. But let me again inculcate, that the wine is not made when the ingredients have been introduced into the vessel. It is then that the labour begins, and nothing but care and attention to every part and every minute circumstance of the subsequent processes can ensure satisfaction, and produce valuable results.

To such uses may the immature fruit of the vine be converted; but the capacities of that plant are not even yet exhausted. Situations may be found in this country where the vine may not produce even immature fruit; yet still it can be directed to the end of wine-making.

Chemical

Chemical examination has proved, that the *young shoots*, the *tendrils*, and the *leaves* of the vine, possess properties, and contain substances exactly similar to the crude fruit. It was no unnatural conclusion, that they might equally be used for the purposes of making wine. Experiments were accordingly instituted in France with this view, and they have been repeated here with success. From vine leaves, water, and sugar, wines have thus been produced in no respect differing from the produce of the immature fruit, and consequently resembling wines of foreign growth. The few experiments which I have tried have been eminently successful. No further rules can be given respecting the management of the leaves, in addition to those I have laid down for the treatment of the unripe fruit. Similar proportions and similar management will in both cases produce similar effects. The leaves, however, scarcely yielding any thing to the press, require to be infused in the water for some days before they are subjected to fermentation, and they seem to yield their soluble parts most readily to boiling water, without any material alteration in the result. The leaves of the Claret vine thus treated produce wine of a delicate red colour. Tartar appears also to be a useful addition in this case; and it may be added in the proportion of half a pound, or even one pound, to ten gallons of the *must*. One advantage results from the use of the leaves. This is the facility with which they are reproduced during the growth of the vine; and thus the produce of a small vineyard in leaves alone will be abundant; and that even of a single vine will be as great as is required for the use of most families, should they make this wine for their sole consumption. Let it always be remembered, that in all these cases the price of the sugar is the price of the wine. The expense of utensils and labour is comparatively trifling,

fling, and when the manufacture is upon a small scale, scarcely worthy of regard.

I have thus brought to a conclusion the remarks which I proposed to make on the art of fabricating wines in Britain. That I have offered so little from my own experience will be pardoned by those who consider that each experiment must extend to a period of one or two years, and that the labour of a life would be insufficient to reduce every one of these suggestions to practice. It will be enough, that they are all readily deducible from the labours of others, or from fair analogies taken from established rules of practice in the wine countries. The co-operation of many, to which I may hope that this Essay will afford additional facilities, will in time improve this practice to that degree of perfection of which it is capable, and establish it on a sure and solid basis.

Woolwich, May 1815.

Note.—The Council of the Caledonian Horticultural Society strongly recommend the foregoing Essay to the attention of all who wish to promote improvement in the manufacture of domestic wines. They suspect, that to many, who are in the habit of making such wines, the general *principles* on which the process depends are nearly unknown, and that others, though in some measure acquainted with these principles, still trust too much to chance.

As the Society will continue to give every encouragement in their power to the improvement of the manufacture of domestic wines, they have earnestly to request every one who may be engaged in it, to keep a memorandum of the whole process which was followed, even

the most minute manipulations. It is intended, when a very superior wine is produced in competition, to bestow a distinguished honorary reward, provided it shall appear that the maker has fully understood, and carefully acted upon, the scientific principles, the only certain guides to success.

The Council may remark, that some individuals in this place have already made considerable progress in naturalising the vine from the seeds of plants kept in the open air; and as there is no difficulty in sowing seeds, (which will vegetate though the grape be unripe,) and in watching when the plants thus produced yield a few grapes in the open air, the seeds of which are again to be sown, proceeding in this way to several generations; hopes may be entertained of some varieties of the grape being obtained, which will never fail to give abundant crops of tolerably ripe fruit, and *that* in no long time, since, under proper management, the vine may be expected to shew fruit in three or four years. In the mean time, the *leaves* (as suggested by Dr. Macculloch) may be tried; but it ought to be observed, that some shoots, from which fruit may be expected, should not be stripped of a single leaf. Indeed, for the purpose of making wine from the leaves, it would be better to plant vines of any sort, and to preserve the seedlings with the greatest care. To give a pleasant colour to wines, the Claret grape may be cultivated for its leaves.

Premiums will be given for Scottish grape wine, and a Gold Medal for the first good Scottish grape raised from seeds produced in the open air in Scotland.

On Wire Grates, as a Means of preventing Wasps from entering Hot-houses.

By Mr. John Hachray, *Errol.*

From the Transactions of the Caledonian Horticultural Society.

THERE are few avocations in life which require more attention to a diversity of objects than that of a gardener.

After having, with the greatest care and attention, brought his trees to a bearing state, he is obliged to maintain a perpetual contest with ignoble enemies: the feeble efforts of puny insects are often to him the source of many painful sensations. Taken singly, they may appear contemptible; but numbers render them formidable. Even the elements sometimes conspire to blast his expectations. On the one hand, he sees aphides in numberless myriads roll up the tender foliage of the peach; the coccus preys upon the bark; and, not unfrequently, the mildew is to be found combined, to deprive the tender shoots of the same tree of vegetable life.

To enumerate all the enemies from which the gardener has to defend his charge, would be to give a list of all the quadrupeds, birds, insects and reptiles, that subsist on the root, the bark, the foliage, or the fruit of plants.

The summer of this year (1814) will be long remembered by the gardener and the bee-master, for the immense swarms of wasps, which so long a tract of dry weather tended to produce. After much labour and expense bestowed on dressing cherry trees, it was painful to the gardener to see the fruit of his labour destroyed, almost instantly, by numbers of voracious wasps. In common with others, I felt the evil severely. No sooner were the cherries devoured, than the strawberries, raspberries,

goose-

gooseberries, and plums, became, each in their turn, the object of their attacks. Even the industrious bees felt the severe effect of their uncommon numbers; so much so, that one of the hives in the garden here was completely subdued. For this last evil I hit on a remedy. I contracted the entry of the remaining hives, and lengthened the passage by a piece of clay, in the form of an arched way; so that the bees met their enemies in a narrow pass, and were thus better able to defend themselves and their treasure.

I had long ago concerted a plan for preventing wasps from entering grape-houses, and I now found it absolutely necessary to put something of the kind in practice.

I had observed an excellent paper on that subject, written by my friend Mr. Dick, which appeared in the fourth Number of the Society's Memoirs *; but not having proper cloth by me, I did not choose to put Mr. Allan to so much expense as that article would have required. The glass in the vinery being cross puttied, I had frames made, three feet square, for the top and bottom of every third sash, the sashes being all moveable: these frames were made exactly to fit between the rafters, and were placed so as the sash could move up and down over them; and that there might not be so much vacuity between the frame and the sash as to admit a wasp, a groove was cut on the under side of the upper bar of the sash, to admit the rope by which the sash is hung. When it comes in contact with the under part of the wire frame, next to the wall plate, there is an aperture to admit the pully; this end inclines downward from the run of the sash, to give room for the rope and pully to work with freedom in opening or shutting.

* See Repertory, vol. XXIX. p. 33.

The frame is made of fir wood, well seasoned, to prevent its warping, and is inch and quarter thick; the sides and lower end are two inches, and the upper end, where the pully is inserted, is six inches in breadth. The open space is covered with wire of No. 17, worked about one-eighth of an inch asunder, and inserted into the wood at both ends. There are cross wires of No. 5, placed at six inches distance from each other, to which the longitudinal wires are warped, to keep them firm. In each of the frames I have made holes, with small wire turned down, similar to the entrance into a wire mouse-trap. At those I place large phials, half filled with sour beer. The wasps are eager to get into the grapes by every possible means of entry, and are next enticed by the beer to enter the phial, where they perish in great numbers.

All fruits raised within the limits of a hot-house require a large portion of air, to render them sweet and high flavoured, particularly at the time of ripening: this will appear obvious, if we compare peaches raised in a hot-house with peaches ripened on an open wall. I shall leave it to chemists to determine by what means the air is rendered less salubrious within than without a hot-house; and shall only mention, that as I judged a free course of air necessary for improving the flavour of the grapes at the time of ripening, I constructed the frames as above described, to admit a sufficient proportion of that essential element.

The frames may be made at a very trifling expense; and as they are in use only about two months in a season, the expense of making new ones will not frequently recur.

I may also mention, that I divested the bee-hive which the wasps had overcome of the remaining wax and honey, and placed in them three mugs, half full of sour beer,

leaving

leaving them in the same place where they were before. By this stratagem I killed about three choppins of wasps daily; so that, with what was destroyed by the phials in the wire frames, I soon succeeded in clearing the ground of them; and preserved the bees from their lawless enemies, and the late wall fruit from threatened destruction.

Description of a Night Telegraph.

By the Rev. JAMES BREMNER, *of the Shetland Islands.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal and Fifteen Guineas were voted to Mr. BREMNER *for this Communication.*

VARIOUS plans have been devised, by means of which telegraphic communications may be conveyed by day to places very distant from one another; but no method has hitherto been invented by which a single word, much less a distinct sentence, can be telegraphically communicated by night, to the distance of even one single mile.

Polybius makes mention of an invention somewhat to this effect, by means of what is called πυρσεια, which clearly signifies signals by fires (not by lights), and probably was no other than what has been common in all ages and countries, *i. e.* by raising large fires on the most conspicuous eminences, to give notice of an approaching enemy, to summon to arms, or to indicate the place of rendezvous, &c.

Mention is likewise made of the number used, as from one to seven. Numbers no doubt would serve to multiply and diversify the intelligence, but still they would be only so many arbitrary signals for special purposes previously concerted; nor is there any reason to believe, either

either from their nature or number, that any communication properly telegraphic could ever have been effected by them.

As a telegraph which could operate by night might be equally useful as one by day, it must naturally have occurred to those who invented the one, to think and consider how the same thing might be done as to the other, but none such existing, it appears that every attempt to invent a night telegraph has hitherto proved abortive.

Having discovered a plan perfectly adequate to the purpose, and presuming to think that the communication of it will not be unacceptable to a Society whose primary principle is to patronize and promote every effort which has a tendency to advance scientific knowledge, or which may conduce towards improvement in any art, I humbly beg leave to submit it to their consideration.

One single light constitutes the whole apparatus; and the whole operation consists in alternate exhibition and occultation of that light.

The further explanation is as follows:

Whenever any communication is to be given, the informant shows his light, and waits till the respondent shews his in return; and having done so for a few seconds, he then retires it, in token that he is ready to observe the informant's motions.

But, previous to any operation, the following plan must have been concerted and settled between the parties. The alphabet, according to the order in which it commonly stands, is to be divided into four parts, to be called the first, second, third, and fourth divisions, thus:

First division	*a,*	*b,*	*c,*	*d,*	*e,*	*f,*
Second division	*g,*	*h,*	*i,*	*k,*	*l,*	*m,*
Third division	*n,*	*o,*	*p,*	*q,*	*r,*	*s,*
Fourth division	*t,*	*u,*	*v,*	*w,*	*x,*	*y.*

In

In the next place, the letter in each division is to have its corresponding number marked below it, thus:

First division	*a*,	*b*,	*c*,	*d*,	*e*,	*f*,
	1,	2,	3,	4,	5,	6,
Second division	*g*,	*h*,	*i*,	*k*,	*l*,	*m*,
	1,	2,	3,	4,	5,	6,

Each of the remaining two divisions to be numbered in the same manner.

The light is to be obscured or darkened by interposing before it a thin board or screen, or otherwise, so as to cover it from the view of the respondent; and every such obscuration is to count one, two obscurations count two, and three obscurations count three, &c.

The use of these obscurations, according to the number made, as one, two, three, or four, serve to indicate which of the four divisions is referred to, and intimates that the letter to be taken down will be found in the division which has been pointed out. Example: If two obscurations had been made (a pause following), it would indicate the second division: if four obscurations had been made, it would indicate the fourth division.

This is the first half of the operation.

The next consists in pointing out the particular letter by so many obscurations as correspond thereto, as one if for the first letter in the division, three if for the third, and six if for the last, &c.

There can only be four obscurations for the division, but there may be six for the particular letter in any given division.

The time allowed for each obscuration is about one second, and for the pause (where it should be marked) about double that time. The first pause which marks the division need not be long; it is sufficient if it can be distinctly observable: but the second pause, indicating

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the particular letter, ought to be long enough to allow time for noting down the letter given.

Thus, the whole operation consists in first marking out the division, and next in marking out the particular letter in the division which had been given.

This can be easily and correctly done by a single person either giving or receiving a communication, if he will only take the trouble of committing to memory the letter and its number in each division.

But it may still be more easily performed by employing two persons on each side.

Of these two persons the business of the one is merely to count the number of the motions made on the light, and to report that number; and the sole business of the other is to mark down the letter agreeably to the report.

Thus the observer of the motions having counted them, and finding there were three, he pronounces aloud three; when he who holds the pen with his alphabet before him, lays his finger upon the third division, and waits; suppose then the next report to be five, this he sees to be the letter *r*, and so writes it down, *r* being the fifth letter in the third division.

Thus the business is made the easiest thing in the world, requiring neither memory nor recollection, but only that the one can count correctly four for the division, and six for the letter; and that the other can note down the letter to which he has been directed.

Where two persons are employed on one side, the distinction of a coloured light for the division, a white one for the letter, would be quite superfluous. At any rate, two could only be correctly managed at the distance of only a few miles, but at the distance of from twelve to twenty miles, if they were not thirty feet asunder, they would appear as one.

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It must be obvious to the slightest reflection, that the use of spy-glasses would lead to endless errors.

I used only one single lamp and reflector, being one of those in the light-house on Copeland Island, and its exhibitions were correctly taken by the naked eye at Portpatrick, in Scotland, without missing or mistaking a single letter. Had any enemy landed in Ireland, I could, in defiance of wind and weather, have sent correct intelligence across the Irish sea every night, and ten times in a night, if necessary, to inform of their numbers, strength, situation, motions, &c.

A little experience suggested some very useful rules. In the first place, whatever is to be communicated ought to be written down in as few words as can be consistent with the clear and distinct meaning.

It was considered that it was possible some error might be made, and made on the most essential word in the whole sentence; and if the whole had been given in continuation, there might be a necessity for going over the whole again.

This would have been a very aukward circumstance; but, to remedy this completely, a sign was settled upon that would indicate when every single word was finished; this sign is given by making a few rapid motions very easily to be distinguished from the ordinary regular motions made in seconds. The respondent had then to look and see if he had got a distinct word, and if he had, his acquiescence showed that all was right; but if it happened otherwise, he was instantly to produce his light, which implied, that the word so challenged must be repeated: thus any error was instantly detected, and immediately rectified, without affecting any other part of the communication. But the communications from Copeland Island to Portpatrick, though they consisted of many hundred

motions, not the error of a single letter was made either in giving or receiving them.

If the whole alphabet were to be used, sixty letters might easily be given in five minutes; and certainly it would require no extraordinary address to comprise some important intelligence in sixty letters; but the process would be greatly abridged by using only sixteen letters in place of twenty-four, and these sixteen will serve every purpose that any greater number can do.

Additional Communication respecting the Rev. James Bremner's *Telegraph.*

As I am extremely solicitous (as some mark of both my respect and gratitude) to render any thing which I have the honour to submit to the Society of Arts, &c. as far worthy of their notice as lies in my power, I have thought of some improvement which might be made both on the day and also on the night telegraph; and I consider it as my duty to submit what has occurred to me on both these points, that the Society may add them, or not, as they shall judge proper, to what I have already stated.

With respect to the day telegraph, which is adapted to an alphabet of sixteen letters only, some may think so many substitutions of one letter for two would be inconvenient and troublesome. In order to remove this objection, a fifth division may be added, (as I think I have already suggested,) to the division side of the telegraph, by means of a particular sign indicating this fifth division.

This sign might be given by bringing a cover over the division part, so that no light would at all appear on that side. To effect this, a Venetian blind might be dropped from above the division side, or by drawing up from below a small frame covered with any thin cloth: this last appears

appears to be the most simple, as requiring only one movement in pulling it up, as, when left at liberty, it would by its own weight immediately replace itself. The letter-side would undergo no change whatever, but would indicate any letter in the fifth division in the same manner as of any other..

Upon this plan there would be five divisions, and four letters to each division, thus,

First division	*a,*	*b,*	*c,*	*d,*
			k,	*t,*
Second division	*e,*	*f,*	*g,*	*h,*
Third division	*i,*	*l,*	*m,*	*n,*
	y,			
Fourth division	*o,*	*p,*	*q,*	*r,*
Fifth division	*s,*	*u,*	*v,*	*x.*

The letter *z* seldom occurs, but whenever it does the letter *s* may be substituted for it, to which it is so nearly allied, that the most scrupulous can hardly object to it.

The foregoing alphabet of twenty letters is so ample, that whoever understands any alphabet at all must deem it perfectly sufficient for every purpose.

Upon the same plan and arrangement of the alphabet the night telegraph may be used.

There will be five obscurations to show the division, and only four obscurations to point out the letter in the last division given; and, whilst it will be equally correct and distinct, it will shorten the operation one sixth part. If there be one more obscuration in the division, there will be two less in showing the letter, and being a middle course between the longest and the shortest alphabets, may be thought the best.

As it is of some consequence to know when a word is

 ended,

ended, this might be indicated by two or three obscurations, made by the blind in rapid succession.

There are only two single letters which constitute a word, *viz.* *a* and *j*, and it would be material to mark them as such by the same sign as marks the end of any other word.

Report from the Select Committee of the House of Commons on Steam Boats, appointed to consider of the Means of preventing the Mischief of Explosion from happening on board Steam Boats, to the Danger or Destruction of His Majesty's Subjects on board such Boats; and who were empowered to report their Observations and Opinion thereupon to the House; and to whom the Petition of William Lester, Esquire, was referred:— Have, pursuant to the Order of the House, considered the Matters to them referred, and agreed to the following Report.

YOUR Committee entered on the task assigned them, with a strong feeling of the inexpediency of legislative interference with the management of private concerns or property, farther than the public safety should demand, and more especially with the exertions of that mechanical skill and ingenuity, in which the artists of this country are so pre-eminent, by which the labour of man has been greatly abridged, the manufactures of the country carried to an unrivalled perfection, and its commerce extended over the whole world.

Among these, it is impossible for a moment to overlook the introduction of Steam as a most powerful agent, of almost universal application, and of such utility, that but

but for its assistance, a very large portion of the workmen employed in an extensive mineral district of this kingdom, would be deprived of their subsistence.

A reference to the evidence taken before your Committee, will also show with what advantage this power has lately been applied, in Great Britain, to propel vessels both of burthen and passage, how much more extensively it has been used in America, and of what farther application it is certainly capable, if it may not be said to be even now anticipated in prospect.

Such considerations have rendered your Committee still more averse than when they ventured on the inquiry, to propose to the House the adoption of any legislative measure, by which the science and ingenuity of our artists might even appear to be fettered or discouraged.

But they apprehend that a consideration of what is due to public safety, has on several occasions established the principle, that where that safety may be endangered by ignorance, avarice, or inattention, against which individuals are unable, either from the want of knowledge, or of the power to protect themselves, it becomes the duty of Parliament to interpose.

In illustration of this principle, many instances might be given; the enactments respecting party-walls in building, the qualification of physicians, pilots, &c. the regulations respecting stage coaches, &c. seem all to be grounded upon it. And your Committee are of opinion, that its operation may, with at least equal propriety, be extended to the present case, on account of the disastrous consequences likely to ensue from the explosion of the Boiler of a Steam-engine in a passage vessel, and that the causes by which such accidents have generally been produced, have neither been discoverable by the skill nor

 controulable

controulable by the power of the passengers, even where they have been open to observation.

Your Committee find it to be the universal opinion of all persons conversant in such subjects, that Steam-engines of some construction may be applied with perfect security, even to passage vessels; and they generally ageee, though with some exceptions, that those called High Pressurè Engines may be safely used with the precaution of well-constructed boilers, and properly-adapted safety-valves: and further a great majority of opinions lean to boilers of wrought iron or metal, in preference to cast iron.

Your Committee, therefore, in consequence, have come to the following Resolutions; which they propose to the consideration of the House:

1. Resolved, That it appears to this Committee, from the evidence of several experienced Engineers, examined before them, that the explosion in the Steam Packet at Norwich, was caused not only by the improper construction and materials of the boiler, but the safety valve connected with it having been overloaded; by which the expansive force of the steam was raised to a degree of pressure, beyond that which the boiler was calculated to sustain.

2. Resolved, That it appears to this Committee, That in the instances of similar explosions, in Steam Packets, Manufactories, and other works where steam-engines were employed, these accidents were attributable to one or other of the causes above alluded to.

3. Resolved, That it is the opinion of this Committee, That, for the prevention of such accidents in future, the means are simple and easy, and not likely to be attended with any inconvenience to the proprietors of Steam Packets, nor with any such additional expense as can

either

either be injurious to the owners, or tend to prevent the increase of such establishments. The means which your Committee would recommend are comprised in the following Regulations:

That all Steam Packets carrying passengers for hire, should be registered at the port nearest to the one from or to which they proceed:

That all boilers belonging to the Engines by which such vessels shall be worked, should be composed of wrought iron or copper:

That every boiler on board such Steam Packet should, previous to the packet being used for the conveyance of passengers, be submitted to the inspection of a skilful Engineer, or other person conversant with the subject, who should ascertain, by trial, the strength of such boiler, and should certify his opinion of its sufficient strength, and of the security with which it might be employed to the extent proposed:

That every such boiler should be provided with two sufficient safety valves, one of which should be inaccessible to the engine man, and the other accessible both to him and to the persons on board the packet:

That the inspector shall examine such safety-valves, and shall certify what is the pressure at which such safety-valves shall open, which pressure shall not exceed one-third of that by which the boiler has been proved, nor one-sixth of that which, by calculation, it shall be reckoned able to sustain;

That a Penalty should be inflicted on any person placing additional weight on either of the safety-valves.

4. Resolved, That the Chairman be directed to move the

the House, That leave be given to bring in a Bill for enforcing such Regulations as may be necessary for the better management of Steam Packets, and for the security of his Majesty's subjects, who may be passengers therein.

24 *June* 1817.

After a variety of evidence of several Engineers and others respecting the accidents which have occurred to the boilers of steam-engines, Mr. George Dodd was called in; and examined respecting his safety-valve.

For what purpose do you attend?—To produce a new safety-valve.

What are the advantages attendant on the safety-valve which you have to offer to the Committee?—I propose to the Committee the valve I now offer as a second valve, as it admits of being locked up so as to be inaccessible to the engine-worker; it prevents the possibility of his obstructing its action, either by going into the boiler when the boiler is cool, or under any circumstances whatever.

[The Witness produced it.]

Is there any provision against the valve adhering in any part, so as to prevent its operation?—There is; the safety-valve has not a conical bottom, as is usual in most safety-valves, but has a flat bottom resting upon a flat circular ring, the steam escapes from the sides of the box through apertures, so constructed as that nothing can be introduced to impede its action.

William Lester, Esq. called in; and examined.

What is your place of abode and profession?—I am an engineer, residing at No. 3, Mount-street, Lambeth.

For what purpose do you attend?—To exhibit the plan of a safety-valve, in consequence of my having presented a petition

a petition to the House of Commons, which was referred to this honourable Committee.

Be pleased to produce your plan?—The valve, of which I here deliver in the drawing, is so constructed, as to prevent the possibility of any person having access to it to prevent its action; it is self-acting entirely from the gravity of a column of water acting upon the valve, which prevents its being locked by any mode, and it cannot adhere because it is not a cone acting in another cone, but a flat surface pressing upon the top of a cylinder; and being inclosed in a box, and the steam getting out at the bottom, there is no matter can get upon the valve to cause its adhesion.

*** Mr. William Lester's Letter shall appear in our next Number, with an Explanatory Engraving.

Observations on an astringent Vegetable Substance from China.

By WILLIAM THOMAS BRANDE, *Esq. Sec. R. S.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

THE substance described in the following pages was put into my hands for examination by the President, who received it from China, with some others employed in the art of dying; and although the small quantity hitherto sent to this country, has not enabled me to extend my experiments upon its useful applications as far as I could have wished, I trust that its chemical history will be deemed of sufficient importance to interest the

Royal Society, and to prove its usefulness as an article of commerce, provided it can be obtained abundantly, and at a cheap rate, which I think admits of little doubt.

The parcel containing this substance was marked "Oong poey," *a species of galls used in dying black.* They have the appearance of irregular vesicles, the coats of which are about one-tenth of an inch thick, of a grey and reddish colour, smooth, and very brittle, and containing in their interior a brown powder, among which insects may be discerned by the microscope. Some of these vesicles were adhering to twigs of the tree, and they appear to be formed upon the younger branches.

They have a more austere and purely astringent taste than any other of the vegetable substances of that class I have met with, and they produce, when thrown into any of the red salts of iron, a pure black tint.

Of the source of these bodies nothing is said, but on reference to Du Halde, ("Description de l'Empire de la Chine," &c. folio, Paris, 1735, p. 496,) I found an account of a Chinese drug, entitled *ou poey tse,* and which appears to be the substance in question. Their formation is ascribed to small insects, and the general description of their exterior characters agrees nearly with that I have given: they vary in size, from a small gall-nut to a large chesnut. M. Geoffroy, in the "Memoires de l'Académie Royale des Sciences, 1724," has published a Paper, intituled, "Observations sur les vessies qui viennent aux Ormes, et sur une sorte d'excroissance à peu près pareille qui nous est apportée de la Chine." He conceives that the excrescences occasionally formed upon the elm are similar to those from China, but does not identify the two by any experiments; and indeed it would appear, from the account given by Du Halde, that the *ou*

poey

poey tse are obtained from a very different tree. These Chinese galls are likewise employed in medicine, and a full account of their various preparations are annexed to Du Halde's observations.

My first experiments were directed towards ascertaining the quantity of tannin which they contained, and which I have found considerably greater than that in any other vegetable astringent in common use.

One hundred grains of the Chinese galls, freed from extraneous matters, were reduced to a coarse powder, and infused in cold distilled water, till that fluid ceased to act upon the residuum. The infusion was of a very pale brown colour, and of a highly astringent flavour; it furnished a copious white precipitate, with a solution of jelly, and became deep black upon the addition of the oxy-sulphate of iron. When carefully evaporated to dryness, there remained upon the glass capsule 75 grains of a brown transparent substance, having a resinous fracture, a rough, astringent, and slightly sour taste, and which powerfully reddened litmus paper. It was quite soluble in cold water, and the solution had the same properties as the former, except that its colour was somewhat deeper. It was perfectly soluble in alcohol, (sp. gr. 820 at 60°,) and its properties were not altered by repeated solution in water and evaporation.

It appears from these characters, that the substance in question contains tannin nearly free from extractive matter. Indeed, I am not aware that tannin exists in the same state of purity in any other vegetable product.

The residuum which had resisted the action of water weighed when dry twenty-seven grains; it was digested in two ounces of alcohol, which acquired a slightly brown tint, and was rendered turbid by the addition of water.

 The

The substance that precipitated was fusible and inflammable, and had the other characters of resin. When heated it exhaled a very peculiar odour. There now remained twenty-three grains of a grey substance insoluble in boiling water and alcohol, and which when heated burned quietly away without residuum, and therefore possessed the characters of woody fibre.

During the preceding experiments, several circumstances occurred, which induced me to believe, that the aqueous solution, though remarkably free from extractive matter, contained a considerable proportion of gallic acid; I therefore endeavoured to ascertain the relative quantity of this acid contained in the brown residuum obtained from the watery infusion. For this purpose it was boiled in water with carbonate of barytes according to the process recommended by Sir Humphry Davy, and the gallate of barytes was subsequently decomposed by dilute sulphuric acid; I found it, however, impossible to obtain the gallic acid in a free state, on account of the facility with which it was decomposed on attempting to evaporate the solution.

When lime-water is added to the aqueous infusion of the galls, a copious insoluble precipitate is formed, consisting of tannin and lime, and a gallate of lime remains in solution, which is decomposed by oxalic acid. In this way I succeeded in procuring the gallie acid nearly pure.

I boiled some pure caustic lime in a strong infusion of the galls, and when cold, filtered the mixture: oxalic acid was added as long as it produced a precipitate in the filtered liquor, heat was applied, and after separating the oxalate of lime, a solution of nearly pure gallic acid was obtained.

I have

I have failed in all these experiments in obtaining the gallic acid perfectly pure, but the Chinese galls appear to me to offer a most promising source of that acid in its pure state, and the gallates obtained by the processes above described, seem to be entirely free from extractive matter, and to approach nearer to pure salts than those which are procured from infusions of the common galls.

When the Chinese galls are exposed in a glass retort to the heat of an Argand lamp, a considerable quantity of gallic acid, tainted by empyreumatic oil, rises into the neck of the vessel, and if the heat be continued, the water which is produced dissolves it, and carries it over into the receiver; during destructive distillation, therefore, a considerable portion of liquid gallic acid may be thus obtained.

One hundred grains of the galls, in powder, were submitted to the action of heat, gradually raised to redness, in a retort to which a proper apparatus was adopted for collecting the liquid and gaseous products. They afforded the following results:

	Grains.
Water tainted by empyreumatic oil, and holding gallic acid in solution	50
Gaseous compounds of charcoal with oxygen and hydrogen	10
Charcoal remaining in the retort, and affording traces of minute quantities of lime	38
	98

It appears from the foregoing experiments, that the substance existing in the Chinese galls which has the power of forming an insoluble white precipitate with animal

animal jelly, and which has a purely astringent flavour, is also perfectly soluble in alcohol; hence it seems, that the assertion of many chemical writers concerning the insolubility of pure tannin in that menstruum is not correct. In this respect the tannin of the China galls resembles that obtained from catechu, the properties of which have been examined by Sir Humphry Davy *, and it is probable that the tannin described by Bouillon la Grange † as insoluble in alcohol, obtained from infusion of galls by carbonate of ammonia, was not pure.

The want of extractive matter in the China galls would probably render them very unfit for the purposes of tanning, and I do not find from Du Halde, that they are ever applied by the Chinese to that use. I found the leather produced by their infusion extremely brittle when dried. The same circumstance, however, namely, the absence of extractive principle, probably would materially contribute to their excellence as a source of the black dye, the intensity and perfection of which is, I conceive, often interfered with by the presence of extractive matter in the common gall nut, and other vegetable astringents usually employed. These galls are likewise particularly proper for the production of writing-ink, the tendency of which to become thick and mouldy seems principally to be derived from extractive matter.

* Phil. Trans. 1803.

† Annales de Chimie, vol. LVI.

List

List of Patents for Inventions, &c.

(Continued from Page 128.)

THOMAS WEDLAKE, of Hornchurch, Essex, Agricultural Implement-maker; for certain improvements on ploughs. Dated July 5, 1817.

DAVID BREWSTER, of Edinburgh, Doctor of Laws; for a new optical instrument, called the Kaleidoscope, for exhibiting and creating beautiful forms and patterns of general use in all the ornamental arts. Dated July 10, 1817.

SAMUEL BROWN, of Mark Lane, Commander in His Majesty's Royal Navy; for an improvement in the construction of a bridge by the formation and uniting of its component parts in a manner not hitherto practised. Dated July 10, 1817.

WILLIAM HENRY SIMPSON, of Bickington, Devonshire, Mechanic; for certain improvements in the machinery for the spinning of wool, cotton, and other fibrous substances. Dated July 10, 1817.

RICHARD FARMER BRAIN, of Salford, Lancaster, Brewer; for an improvement or apparatus calculated to obtain or generate gas in a more economical manner than heretofore from coal, or any other article, material, or substance, for lighting or heating houses, manufactories, or other places where light or heat is required. Dated July 10, 1817.

HENRY TRITTON, of Clapham, Surrey, Esquire; for an apparatus for distilling. Dated July 15, 1817.

THOMAS ASPINWALL, Esquire, of Bishopsgate Churchyard, London; for an eliptic valve-pump-box. Dated July 16, 1817.

REUBEN

Reuben Phillips, of Exeter, Gentleman; for a method of purifying gas for the purpose of illumination. Dated July 19, 1817.

George Wyke, of Bath, Somersetshire, Esquire, and Edward Shorter, of Union-street, Borough, Surrey, Mechanic; for certain improvements in the construction of wheel carriages. Dated July 19, 1817.

Peter Hamlin, of Albany Place, Kent New Road, Camberwell, Surrey, Merchant; for an improvement or improvements in the making a cement or composition for ornaments and statues, and for making artificial bricks, or an imitation of bricks, tiles, and stones, and joining and cementing the same, and for erecting, covering, and decorating buildings, internally and externally; and also an improvement or improvements in the mixing, working, and moulding of the said cement or composition upon any sort of materials, or in working and moulding whole and entire erections and substances therewith. Dated July 19, 1817.

Frederick Brunton, of Bride-lane, Fleet-street, London, Gentleman; for a mode of employing silk or other materials in the makings of hats and bonnets. Dated July 19, 1817.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLXXXIV. SECOND SERIES. Sept. 1817.

Specification of the Patent granted to WILLIAM DEAN, *of Manchester, in the County of Lancaster, Calico Glazier; for certain improved Machinery for waxing Calico, or any other Cloth or Fabrick, previous to the Process of Glazing.* Dated December 14, 1816.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Dean do hereby declare that my said invention, and the manner in which the same is to be performed, is particularly described and ascertained in manner following: that is to say: My said invention consists in such an arrangement of machinery, moved by any suitable physical or animal power, as enables me to apply the wax to the calico, or other cloth or fabric, in a manner not hitherto practised by others, and which I find to be preferable to any of the methods hitherto in use. That the novelty and the nature of my said invention may be more easily apprehended and understood, I

have to premise that the method or methods hitherto employed for applying wax to calico, or other cloth or fabric, previous to the process of glazing, has been by rubbing the wax by hand on the calico, or other fabric, on a flat table, or by applying the wax (sometimes by machinery) to the surface of the calico, or other cloth, in the same or in a manner similar to that by which the flint is applied in the process of glazing; that is to say: The calico remained stationary while the wax applied to it was kept in motion, or the web was made to move slowly along the table, the wax being at the same time kept in motion; but by my said invention, the calico, or any other cloth, to be waxed, is made to rub against the wax while the wax is kept stationary.

Such being the object and purpose of my invention, any competent mechanist will easily perceive that it does not consist so much in the particular form or arrangement of the machinery by which this may be effected, as in the ultimate effect to be gained by the arrangement, whatever the arrangement and parts of the machinery may be, for those may be altered and varied in innumerable ways.

As, however, a particular description of a machine or mechanical arrangement, which has been found to answer in practice, will at once illustrate the nature and principle of my said invention, and at the same time serve to direct the attention of such as may, after the expiration of the said term, wish to exercise my said invention, to those points which they ought more immediately to keep in their eye for gaining the desired result I will here give a description of such a machine, or arrangement of machinery, with proper references to drawings of the same hereunto attached. I shall call Fig. 1 (Plate VI.) a front view, and Fig. 2 a back view; and whenever the same letters of reference

reference are seen in both, they refer to the same parts. A is a carriage to support the delivering roller B, on which the web W to be waxed is rolled up before beginning the work. From the roller B the web passes over stationary friction staves or bars C C C; those may be more or fewer in number according to the breadth of the webs, or other circumstances, their use and intention being to convey the web to the cylinder or drum D, under a sufficient degree of tension to prevent creases or wrinkles. The web passes over the cylinder, and at the same time under the wax boxes E, (hereafter more particularly to be described,) after which it passes under the roller F, Fig. 2, and thence to the reviving roller G, on which it is wound or rolled up. Such or any similar arrangement and adaptation of parts being adopted, it is obvious that if the cylinder or drum D be kept in motion by any suitable means, as by the band or strap H (connected with a steam-engine or any moving power) passing over the pulley I, which said pulley is on, or connected in, a line with, so as to be moved by, the axis of the cylinder or drum D, then the rollers before described may each be easily kept in motion, and made to perform their respective offices. Thus, in the arrangement that has been described, the roller F being kept sufficiently close to the cylinder or drum D with the web between those two, the web must pass on to the receiving roller G, which receives motion by a strap or band passing over a pulley K on the same axis, and over a pulley L on the axis of the roller F. [Or another roller, placed at any other convenient part of the cylinder, and driven by it, may be employed to carry the pulley L, and give motion by a band or strap to the pulley K.] These, or similar parts, or other mechanical contrivances, adapted to give

the same result, being connected and kept in motion, it is obvious that all the parts of the web W, must be brought forward, and made to pass in uninterrupted succession under the wax boxes E, which I will now describe.

Fig. 3 represents one of the wax boxes. It is made of metal, and for the cheapness I prefer cast iron. I tmight be made of wood, but this would require, that when in use it should be loaded with weight, or pressed down by some mechanical contrivance, to make it apply with sufficient force to the web, which necessity is most conveniently avoided by making the box itself to press the wax to the web by its own weight, which may conveniently be from forty to fifty pounds. The opening represented in the lower part of the box, exhibited in Fig. 3, receives a long cake of wax M, cast in a mould, to give it the required form; and the cake of wax is kept in its place by screws and nuts, or any suitable contrivance. Each end of this box is received into a groove, or between pins, in the frame-work, the grooves or receptacles for the said ends answering each to part of a radium line drawn from the axis of the cylinder D. In this description I have confined myself to one wax box, for the sake of perspicuity, but by the drawings it will be seen that six or eight (or more or fewer) are all used at once, to give the required degree of waxing, and to insure the more equal and effectual distribution of the wax on the surface of the web as it passes with the revolving cylinder D under the boxes. For the reception of these, a sufficient number of grooves (answering to radii, or nearly so, of the cylinder D) are provided in the frame-work, (see the drawing); and for the convenience of lifting the wax boxes all at once at any time, or letting them down, each

box

box (by means of a rope or chain from each end) is connected with the carrier or lifter N, moveable by a common lever O, having its fulcrum or pin at any convenient place P.

N. B. The radiating grooves at each end of the framework, and extending a sufficient length beyond the diameter of the cylinder, for the purpose of receiving the ends of the wax boxes, may for each end be made in one piece of cast iron. That the machinery may best answer its intended purpose, it is proper that the drum D should be covered with some kind of cloth. That which I have found to answer best is that made of woollen, which is commonly called stout printers' blanket. I need only further remark, that (as is common in machinery) there should be the usual means for throwing the work in or out of gear, as the slide box *a a*, the lappets or clutches *b b*, with a lever or handle *m*, conveniently poised to put their action under the controul of the workman, and that the inner ends of the axles of the pullies F and G, but especially of the latter, should have square sockets to receive square ends of the axles or rollers, for the greater convenience of changing the rollers, when one is removed with its web to make room for another. The framing needs no particular description. It may be of wood or of cast iron.

To conclude, I do not rest my claim to the use of my invention for the said term on the particular parts organised into one machine, which have been mentioned above, as cylinders, roller-pullies, and straps. These are old contrivances, and are common to almost every description of machinery. My invention consists in arranging these, or any of the common mechanical contrivances in use, in such a manner as to enable me to make all the parts of the

the web that is to be waxed pass in regular succession along the surface of the wax, being at the same time pressed against the web by weight, or otherwise, the wax pieces being stationary, and the web in motion during the process, as above described.

In witness whereof, &c.

Observations by the Patentee.

First. By means of my machine the wax is laid upon the piece uniformly. In this respect it possesses a great superiority over hand work.

Second. It is much less liable to damage the piece than the usual method.

Third. It enables a person to put a much superior gloss upon the goods; and it has a surprising effect in raising the colours.

Fourth. A piece passes through the machine in about fifteen seconds. Now supposing the average time of waxing by the hand to be ten minutes *per* piece, which is, I believe, a moderate statement, it is evident that for every piece waxed by the latter method forty would be waxed by the machine.

Fifth. This method of waxing is more economical than that in general practice, exclusively of what is gained by men's wages.

Specification

Mr. Dean's Patent.

Fig. 1.

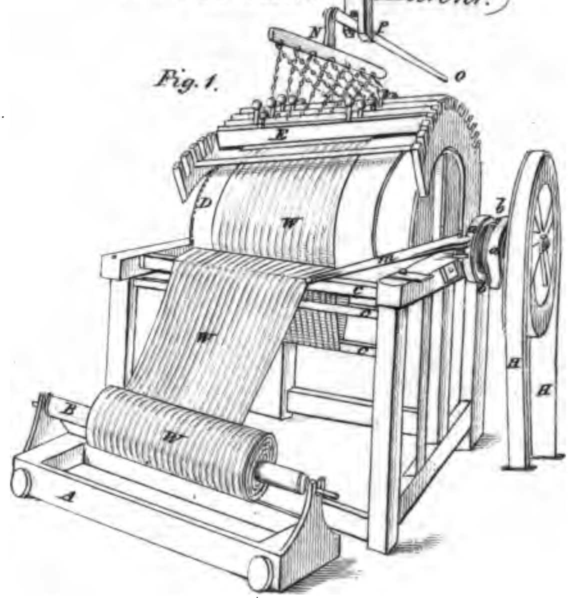


Fig. 3.

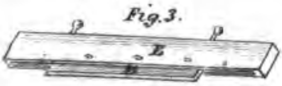
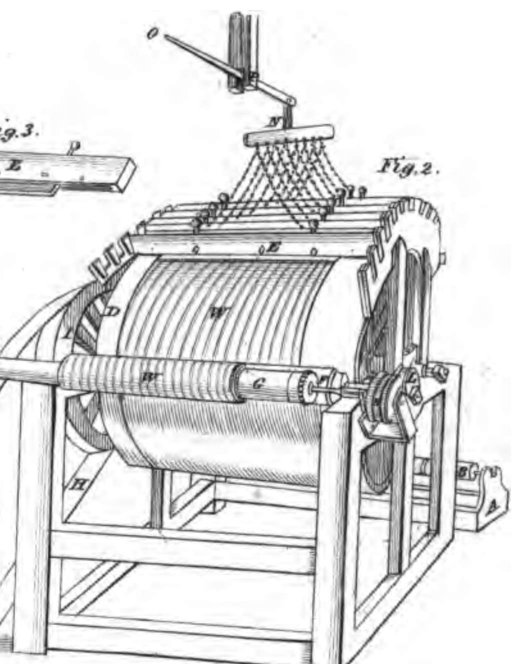


Fig. 2.



Specification of the Patent granted to SAMUEL NOCK, *of Fleet-street, London, Gun-maker; for an Improvement in the Pan of the Locks of Guns and Fire-Arms.*

Dated August 12, 1816.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said recited proviso, I the said Samuel Nock do hereby declare that my said invention is described in the drawing hereunto annexed, and the description hereunder written; that is to say: The improvement consists in a hollow tube or chamber in the pan of the lock opposite to the touch-hole of the barrel, and lying in such a direction as that a straight line passing through the centre of such tube or chamber from one end to the other would enter the touch-hole of the barrel. This tube or chamber in its length occupies about three-fourth parts of the length of the pan, leaving the remaining part of the pan between it and the touch-hole of the gun a free space, or it may occupy in its length the whole or any part of the length of the pan. That end of the tube or chamber nearest the touch-hole of the barrel is open, the other, or exterior end, is closed or stopped up, either by being left or made solid, or by a screw, plug, or slide applied to such exterior end, and which screw, plug, or slide, if capable of being removed or taken out, will facilitate the cleaning out of the tube or chamber when foul. The tube or chamber can be made of such proportionate size to the pan as to be wholly or partly covered with the gunpowder, and to leave either the whole or part of the surface of the pan to be covered with gunpowder.

powder. A small hole or vent, resembling a touch-hole, is made in the tube or chamber near to its exterior end, whereby a more ready communication between the gunpowder on the surface of the tube or chamber, and the gunpowder within it, is obtained, though such hole or vent is not absolutely necessary. This tube or chamber may be shortly described, as resembling a small cannon fixed in the hollow of the pan opposite to, and firing straight into the touch-hole of the barrel. This improvement may be applied to all sorts of guns and fire-arms; but it is more peculiarly adapted to such as prime themselves from the loading or charge put into the barrel.

For the more minute particulars the details in the annexed drawing may be referred to.

Fig. 1 (Plate VII.) is a view of the lock-plate, with the improved pan applied to it. A, is the pan. B, the tube or chamber in the pan, in a line with the touch-hole of the barrel. C, the interior, or open end of the tube. D, the free or open space between the interior end of the tube and the touch-hole of the gun. E the hole, resembling a touch-hole, on the surface of and into the tube, near its outward or closed end. F, the outward or closed end.

Fig. 2 is a view of the improved pan, presenting its appearance when the lock is screwed or fastened to the barrel, shewing the outward or closed end of the tube or chamber stopped up by means of a moveable screw, plug, or slide marked F. C, is the interior or open end of the tube or chamber, placed opposite to, or in a line with, the touch-hole of the barrel.

In witness whereof, &c.

Specification

Mr. Pering's Patent.

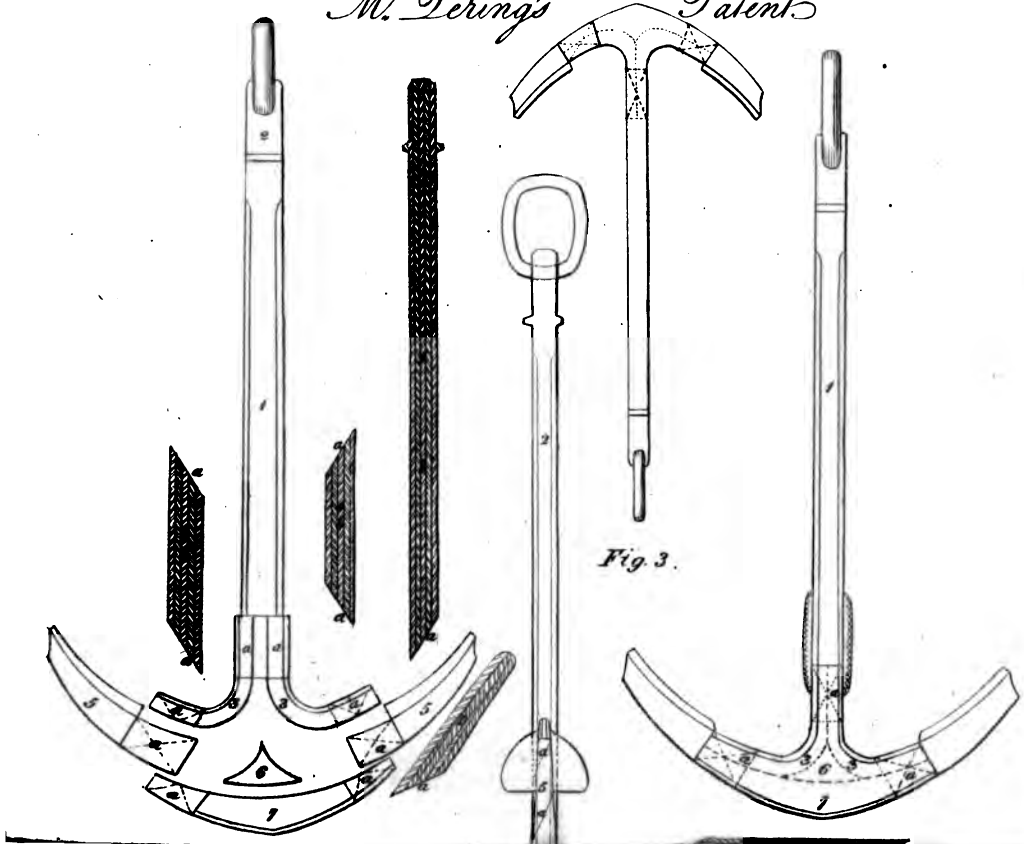


Fig. 3.

Mr. Nock's Patent.

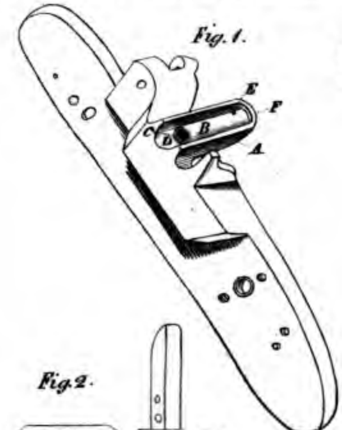


Fig. 1.

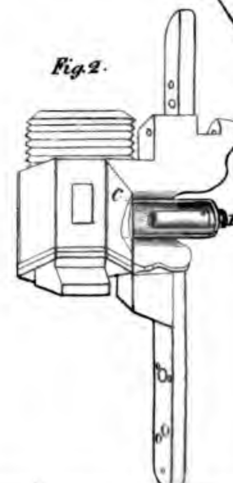


Fig. 2.

Specification of the Patent granted to Richard Pering, *of His Majesty's Dock-yard, in the Parish of Stoke Damarell, in the County of Devon; for a Method of making an Anchor on new Principles.*

Dated July 23, 1813.

With an Engraving.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said Richard Pering do hereby describe and ascertain the nature of my said invention, and in what manner the same is to be performed, by the plan or drawing in the margin of these presents, and the following description thereof; that is to say: First, in continuing the grain of the iron from the shank into the arms, similar to the shape of a knee or arm of a tree, whereby the necessity of effecting a junction at the crown, as at present welded, is superseded. Secondly, in carrying a piece of iron across the crown from the centre of each arm, making thereby a perfect truss, which when welded resembles the form of a truss beam. Thirdly, in forming both the shank and arms of flat bars, placed so as to act edgewise on the line of resistance when the anchor is in the ground. And, fourthly, in forming the longest part of the shank one-third down from the crown in a line across from toe to toe of the arms.

In witness whereof, &c.

Reference to the Engraving.

Fig. 3, (Plate VII.) 1 and 2 shank with flat bars, acting edgewise as 2. 3 and 4 throat pieces for connecting

 shank

shank to fluke, made with flat bars, acting edgewise. 5, flukes made with flat bars, as throat pieces. 6, chock between flukes and span piece. 7, span piece, combining throat pieces and flukes together, acting as a truss. *a*, scarphs; *b*, anchor, shewing the edges of the flat iron.

Specification of the Patent granted to JOHN SPARKS MOLINE, *of Leadenhall-street, London, Leather Merchant; for an improved Method of Tanning Leather.*

Dated March 28, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Sparks Moline do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described in manner following; that is to say: I make a solution or infusion, by means of water, (either hot or cold, but in preference cold,) of oak bark, or any other vegetable matter or substance which possesses the power or quality of tanning the hides and skins of animals according to the usual mode of tanning, excepting such vegetable matters as are used for producing the substance known and employed in medicine by the name of catechu, or terra japonica, and also excepting Mangrove bark. And I filter the said solution through a close filtre of canvas, or fine particles of sand, or of such other articles, materials, and construction, as are known in the common practice to be suitable for the performing the act of filtering with good effect. I do then inspissate or concentrate the said solution or infusion by means of heat, or by means of the exposure of a large surface of the said fluid to the atmosphere in the manner denominated gradua-

tion

tion in some salt-works, or by other well-known means, whereby the water may be less or more evaporated. After which I compleat the inspissation or concentration by the use of heat with stirring, until the mass becomes very stiff, and upon cooling acquires the solid state, and is then capable of being conveniently packed and carried to any place or places at which the same may be applied to use.

And I do further declare, that although the said inspissation, concentration, and reduction, of the solid state may be effectually performed by the heat of a fire, so carefully applied as not to burn, scorch, or alter the nature of the product, yet I greatly prefer, and generally use, the application of heat by means of a bath of heated water, or more especially of steam, because in such baths the heat may with facility be kept permanent, or may be measured and regulated as to the intensity thereof, which is such, as that the heat of the solution or infusion is generally below that of boiling water; and it is proper that no vessel of iron should be used, or any iron brought in contact with the said solution or infusion in any part of the process.

And I further declare, that I apply and use the said inspissated and solidified mass, for the tanning of hides and skins, by dissolving the said mass in water, and filtering the solution, if required, through a close filter, as hereinbefore mentioned and described, and using the same, by immersing the hides and skins therein in the customary manner, making such solutions weaker or stronger as the several stages of the process may require, which will be well understood by those who are accustomed to the business, without any further or more precise instructions on this head. Or I use the said solidified mass, or the solution of it, above described, by add-

ing it to any or all of the oozes or infusions of oak bark, or other materials used in the ordinary mode of tanning.

And, lastly, in case it be required that the leather should possess that aspect or appearance which is called the bloom, the same may be given by finishing the process with oak bark, in the manner heretofore practised in the common process of tanning.

In witness whereof, &c.

A Letter of Mr. WILLIAM LESTER, *to the Honourable Committee of the House of Commons, on the Construction of Steam Boats; promised in our last Number.*

With a Wood Engraving.

From the REPORT of the SELECT COMMITTEE of the HOUSE of COMMONS.

GENTLEMEN,

I PRESUME that all the boilers of steam-engines which have exploded by the pressure of the steam, have been in consequence of the nature, form, and position of the apparatus hitherto very improperly called the Safety Valve, which has been invariably placed at the command of the person attending the engine, and thereby dependent upon his attention, and so constructed, that he can add to or take from what weight he pleases; and who is always taught to understand, that the more weight he puts upon this valve the more power the engine will have, without being at the same time fully apprised of the danger that might arise from an overcharge, in consequence of the least lapse of his attention. This, by the number of dreadful catastrophes that have occurred, fully proves, that whatever is left to the constant attention of man,

man, cannot be safe. The engine, by its own motion, opens and shuts the nossal valve, and thereby feeds the cylinder with the proper portion of steam which is necessary for its own action, and also discharges that steam when it has performed the operation of pressing down or raising up the piston; but as the degree of heat, that raises that steam in the boiler, is always varying, more steam is raised at times than can be exhausted by the working of the engine. This superfluous steam, accumulated by an increasing heat, renders an outlet necessary to carry it off as fast as it is raised. This outlet for the discharge of this superfluous steam renders a valve for the purpose of economy and safety indispensable, and which should be so constructed and placed, that the attendant or any other person could not approach it. That it should at all times act entirely independent of human attention, and solely by the pressure of the superfluous steam, which would enable the engine to perform this operation with the same continued regularity and accurate effect, as it does that of opening and shutting the valve betwixt the boiler and the cylinder, and by that means entirely remove the possibility of explosion. This valve or apparatus should be loaded with a given and necessary weight, that cannot by any human means receive an addition; and so constructed as to have no friction, or be liable to any kind of lockage from the expansion of the heated metal, but to regularly recede from the increased pressure of the superfluous steam, and open the passage for its escape into the atmosphere.

The term used by engineers for high and low pressure boilers, requires some explanation, for, as it is generally used, it implies that they are a distinct species; whereas every boiler, of whatever form or construction, is high or low pressure according to the degree of heat that surrounds

rounds it. The difference is, that one kind of engine requires more power upon the inch than another, to overcome the atmospheric pressure; as in one the steam is condensed by cold water, and from the other the steam is thrown off into the air without condensation. It follows, of course, that the latter requires more power than the other, and should have boilers made of a proportionate strength. But as all metals, whether cast or wrought, are liable to be weaker in one part than they are in another, (the weak parts of which are not visible to the most accurate inspection, and can only be discovered by submitting the boilers to proof,) I would beg leave to suggest, that an officer be appointed by Government to prove all boilers, at the proper periods of time that may be deemed expedient, for all engines that are employed for the conveyance of passengers, and all boilers that may be used for other purposes with high pressure steam, where the lives of his Majesty's subjects are endangered.

If your honourable Committee should deem it expedient to recommend to the House, legislative measures to compel the proving of all boilers that are liable to explosion to endanger the lives of his Majesty's subjects, such measure cannot in any way affect the interests of this or that species of engine, or impede the progress of improvement, as the public might be left at liberty to use every kind of engine that is or may be made, but subject to the necessary proof and other means to prevent explosion. This, I presume, would operate as an encouragement to the art, by establishing and restoring that confidence which has been so much shaken by the late catastrophes.

As all steam-engine boilers have hitherto been liable to explode, from the accumulated pressure of steam, in consequence

consequence of the imperfection of the apparatus called the Safety Valve, I beg leave to offer to your honourable Committee, a calculation of the expansive force of the steam in different-sized engines, which, I have no doubt, will make obvious the necessity of some parliamentary regulation in the application of this tremendous and powerful agent. It only requires a few figures, and the perusal of the evidence before your honourable Committee., to show the necessity of something being done without delay, for the sake of humanity, lest another cargo of passengers be destroyed before the necessary precautions can be adopted.

A boiler for a 14 horse power engine should contain sixty superficial feet on the surface of the water, and produce 300 cubic feet of steam *per* minute, of the expansive force of five pounds upon the inch for a condensing engine, amounting to 72 tons expansive force upon the inner surface of the boiler, containing 162,280 inches and 230 cube feet of steam-space. If used as a high pressure boiler, working at 40 pounds upon the inch, the expansive force within the boiler will be equal to the weight of 576 tons, which steam must be raised from the water in less time than one minute, to keep the engine at work. If any impediment or obstruction should prevent the action of the safety valve, and the engine cease working, then, according to the ratio of increase, the expansive force would accumulate, in less than three minutes, to the amount of 1,152 tons pressure upon the inside of the boiler.

A boiler for a 20 horse power engine contains 90 feet upon the surface of the water, the boiler fifteen feet long, six feet wide, and seven feet high, having on the inner surface 280,800 inches, which at five pounds upon the inch, amounts to 127 tons expansive force, at forty

forty pounds upon the inch to 1,016 tons. The cylinder, containing seventeen cube feet of steam, which it exhausts thirty times *per* minute, amounting to 540 cube feet, which must be raised from the water in that space of time to keep the engine at work. Should the action of the safety valve be impeded, and the engine cease working, the expansive force of the accumulated steam in the boiler would be doubled in less than three minutes, equivalent to the weight of 2,032 tons.

A boiler for an eighty horse power engine would contain 360 feet upon the surface of the water, and on its inner surface 1,123,200 inches, which, at five pounds upon the inch, would amount to 508 tons expansive force, and at forty pounds upon the inch to 4,064 tons. If the engine stopped working, and the safety valve did not act, the increase in three minutes would amount to 8,128 tons. If this boiler was to be made strong enough to support the pressure of 600 pounds upon the inch, the expansive force would be equivalent to the enormous weight of 60,960 tons. How wonderful that more explosions have not already occurred!

I made many experiments last summer on the apparatus called a safety valve, for the purpose of rendering a boiler safe which was fixed, and formed a part of the cabin of a canal boat; the result of these experiments was, the invention of an apparatus that has all the requisite advantages to do away the possibility of explosion. It has a weight that can receive no addition, which is always ready to recede when acted upon by a greater force than what it contains within itself. It has no friction, and cannot lock by the expansion of metals. It cannot be bound down or fastened by any means, without destroying the working power of the engine, or letting the steam out of the boiler as fast as it is raised. It acts at all times

with

with one continued regularity when put in motion by the pressure of the superfluous steam, and that entirely without the attention of man. The weight is a column of water which can receive no addition in consequence of its fluidity, and recedes upwards from the pressure of the steam when that is stronger than its own weight. It will appear obvious, by the inspection of the working model or the accompanying sketches, that it is calculated, with the aid of the necessary proof of the boiler, to render explosion impossible, and thereby constitute a most perfect safety valve.

The accompanying *sketches are the outlines of two apparatuses* invented by me; one for the purpose of proving the strength of boilers, and the other for letting the steam escape when it arrives at a given pressure. The one for proving boilers is far superior to the mode used by loading the valve by additional weight, as it is not like them subject to friction, and consequently is not liable to lockage. The weight pressed upon every square inch of the boiler is most accurately ascertained at the first view, whereby all errors of calculation are prevented. A boiler proved by this apparatus to the extent of 150 pounds pressure upon the inch, by an officer appointed for that purpose by Government, and the hydrostatic safety valve graduated to the working line, say 100 degrees below proof, properly attached, will never under any circumstances explode. It would be proper that the proprietor, or the engineer who attends the engine, should be furnished with a certificate, specifying the date and extent of the proof, also the working line of the safety valve, and signed by the proving officer. This certificate should be shown to any passenger demanding to see the same; by which not only the lives of his Majesty's subjects would be preserved, but their minds would be rendered perfectly at ease on the subject of safety.

 I shall

I shall take the liberty to exhibit to your honourable Committee, a working model of my hydrostatic safety valve, when I trust you will call before you professional men of science to examine its principle and action; as I should feel great pleasure if any gentleman could point out the probability of its motion being stopped or impeded, or anyways obstructed, by any external interference; or how it might be liable to any internal impediment, by which its motion may be rendered uncertain or irregular, not corresponding with the impulsive lifts and throws of the accumulating and superfluous steam. I conclude, that this apparatus, with legislative aid to compel proof, will make steam-engines and steam-boilers, of every description of form, size, or construction, produce with their own innate action, from the elasticity of their steam, their own security, independent of the least care or attention of man. With the hope of accomplishing this most desirable and important purpose, I shall endeavour to render all the assistance within my power; and trust that my humble efforts will meet the approbation of your honourable Committee, and that the honourable House of Commons, for the sake of humanity, will adopt such measures as they in their wisdom may think fit.

I am, Gentlemen,

Your most humble and very obedient Servant,

at command,

London, May 29, 1817. WILLIAM LESTER.

A Descriptive Reference and Explanation of the Drawings.

Fig. 1, a hydrostatic apparatus for proving the strength of steam-boilers, by water injected from a force pump. A, a cistern made of leather, attached to a metal top, and filled with water, and inclosed in a metal box. B,

B, a tube rising from the centre of the metal top, and communicating with the water in the cistern; the diameter of this tube being as 1 to 28 compared with the diameter of the box, the area of which will be as 1 to 588. A column of water in the tube B an inch square and thirty-five inches high, would press upon the piston C the weight of 588 pounds, suppose the piston B to be one inch in diameter. Water being forced with a force pump into the boiler, when full will press against the piston C, whose cap or flange acting upon the leather which supports the water, with the force of 588 pounds, before it can force the water in the tube B above thirty-five inches high, allowing the tube B on the piston C to be one inch in area, which would give a pressure of that amount upon every inch of the boiler. The tube B is made of glass, and marked with an index of figures, denoting the pressure at different heights, and the reservoir or bulb D filled with oil coloured, which leaves a mark within the tube, showing how high the pressure had been made in the boiler.

Fig. 2, a hydrostatic valve or apparatus, connected by a tube with the steam space in the top of the boiler. A, a cistern of water, made of leather, which, when pressed upwards by the steam acting upon the valve C, forces the water into the chamber B, as seen in Fig. 3. When the steam is exhausted to the same pressure as the weight of the column of water in the tube E, acting upon the leather at the bottom of the box A, the valve C closes, and remains so till the steam in the boiler gets up to a higher pressure.

Fig. 3, C, shows the valve up, and the steam rushing out. B, the water which has risen from the box A by the rising of the valve C, and which returns on the valve's closing into the box A, as seen in Fig. 2.

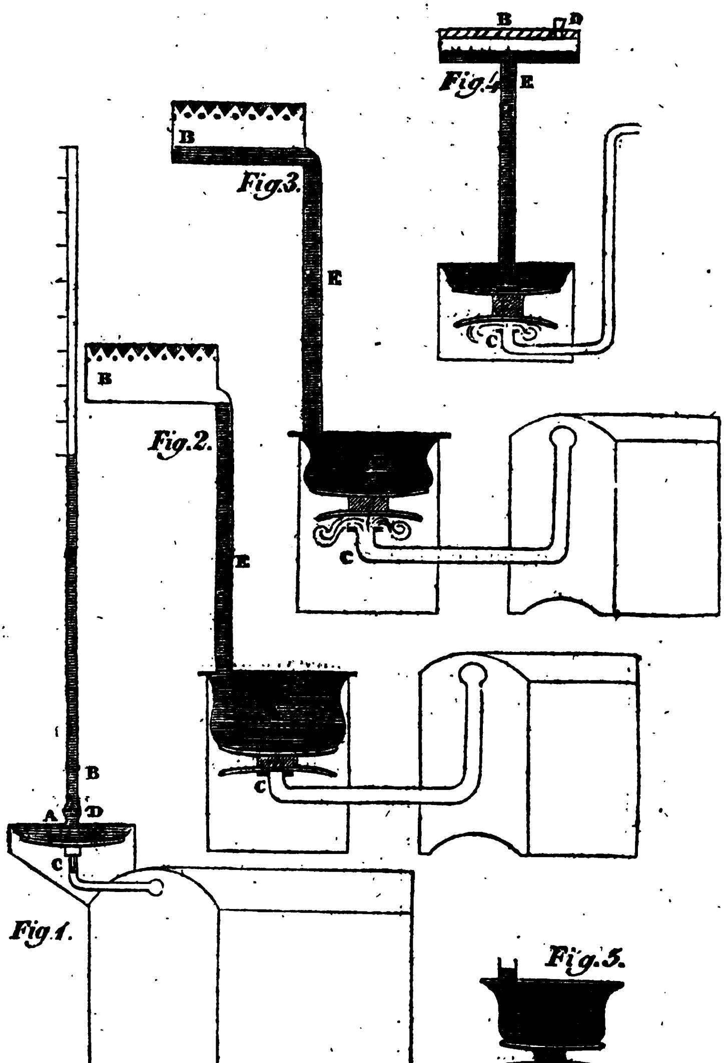
Fig. 4, B, the receiving chamber, which is covered at the top securely, but perforated with diagonal or other irregular sized holes, to prevent the possibility of the tube E being stopped or closed by any external interference. D, a funnel through which the water is put to fill the box A. The stem of the valve F being made of wood, prevents the leather in the box A from being injured by the heat of the steam.

Fig. 5, the valve, with a concave top and a concave bottom. On this the leathern cistern of water presses, as shown in the other figures.

This hydrostatic valve is self-acting, and evidently secure; it cannot be injured or loaded by any external or internal violence, without letting off the steam; and therefore the injury, if any should occur, is on the safe side, and would, from its simplicity, cost little to repair. It will admit no more weight than the height of water to the top of the chamber B of the same area as the tube E. Its power and weight are always in proportion to the height of the tube E, compared with the valve-seat C, and the horizontal area of the top of the box A. In this figure the box A is fourteen times the diameter of the tube E, which is in area as 1 to 147; consequently the height of the tube E must be governed by the weight required upon the area of the valve-seat C. This water or hydrostatic lever has a very great advantage over all others for this particular purpose, as it never can be thrown off its centre of action by any probable inclination, rocking, motion, or violent concussion, which either vessel or carriage may be liable to. When the water in the tube E is wasted by evaporation, it may immediately be supplied by means of the funnel D, as shown in the chamber B, Fig. 4.

Mr.

Mr. Lester's *Sketches of Apparatus for proving Steam-Engine-Boilers, and of improved Safety-Valves.*



A Description

A Description of a Process, by which Corn tainted with Must may be completely purified.

By CHARLES HATCHETT, *Esq. F. R. S.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

THE very great loss which this country formerly experienced by a considerable part of imported grain having been contaminated by Must, induced me, several years past, to direct my attention towards discovering some simple and economical method by which this taint could be removed, and you well know that my endeavours were successful; but as circumstances at that time, and since, did not appear to require that great publicity should be given to this process, I contented myself with describing it to you and a few of my other friends. Now, however, when I reflect on the large quantities of corn which, during the last harvest, have been housed in a damp state, and on the great importations which are expected, with the extreme probability that a considerable part may have contracted Must, and that thus the object of importation may be partially frustrated by the destruction of a large portion of grain, and the consequent increase in the price of the remainder, I think it incumbent on me to lose no time in publishing a process by which corn, however musty, may be completely purified, with scarcely any loss of quantity, with very little expense, and without requiring previous chemical knowledge or chemical apparatus.

The experiments which I made were confined to wheat, as being of the greatest importance; but there can be no doubt that oats and other grain may be restored to sweetness with equal success; and I have also additional satisfaction from being enabled to state, that the efficacy

of

of the process may be ascertained by any person, in any place, and upon any quantity of grain, however small.

From my experiments I am inclined to believe, that Must is a taint produced by damp upon the amylaceous part of the grain or starch; that the portion of starch nearest to the husk is that which is first tainted; and that the greater or less degree of Must is in proportion to the taint having penetrated more or less into the substance of the grain. In most cases, however, the taint is only superficial; but, nevertheless, if not removed, it is sufficient to contaminate the odour and flavour of the whole, especially when converted into flour.

After various experiments, I found the following method to be attended with success.

The wheat must be put into any convenient vessel capable of containing at least three times the quantity, and the vessel must be subsequently filled with boiling water; the grain should then be occasionally stirred, and the hollow and decayed grains (which will float) may be removed; when the water has become cold, or in general when about half an hour has elapsed, it is to be drawn off. It will be proper then to rince the corn with cold water, in order to remove any portion of the water which had taken up the Must; after which the corn being completely drained, is without loss of time to be thinly spread on the floor of a kiln, and thoroughly dried, care being taken to stir and to turn it frequently during this part of the process.

This is all that is required; and I have constantly found that even the most musty corn (on which ordinary kiln-drying had been tried without effect) thus became completely purified, whilst the diminution of weight caused by the solution of the tainted part was very inconsiderable.

Some

Some Researches on Flame.

By Sir HUMPHRY DAVY, *LL. D. F. R. S. V. P. R. I.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

I HAVE described in three papers, which the Royal Society have honoured with a place in their Transactions, a number of experiments on combustion which show that the explosion of gaseous mixtures can be prevented or arrested by various cooling influences, and which led me to discover a tissue permeable to light and air, but impermeable to flame, on which I founded the invention of the wire gauze safe lamp now generally used in all collieries in which inflammable air prevails, for the preservation of the lives and persons of the miners. In a short notice, published in the third number of the Journal of Science and the Arts, edited at the Royal Institution, I have given an account of some new results on flame, which show that the intensity of the light of flames depends principally upon the production and ignition of solid matter in combustion, and that the heat and light in this process are in a great measure independent phenomena. Since this notice has been printed, I have made a number of researches on flame: and as they appear to me to throw some new lights on this important subject, and to lead to some practical views connected with the useful arts, I shall, without any farther apology, present them to the Royal Society.

That greater distinctness may exist in the details I shall treat of my subjects under four heads. In the first I shall discuss the effects of rarefaction, by partly removing the pressure of the atmosphere upon flame and explosion. In the

the second, I shall consider the effects of heat in combustion. In the third, I shall examine the effect of the mixture of gaseous substances not concerned in combustion upon flame and explosion. In the fourth, I shall offer some general views upon flame, and point out certain practical and theoretical applications of the results.

I. *On the Effect of Rarefaction, by partly removing the Pressure of the Atmosphere upon Flame and Explosion.*

The earlier experimenters upon the Boylean vacuum observed that flame ceased in highly rarefied air: but the degree of rarefaction necessary for this effect has been differently stated. Amongst late experimenters, M. de Grotthus has examined this subject. He has asserted that a mixture of oxygen and hydrogen ceases to be explosive by the electrical spark when rarefied sixteen times, and that a mixture of chlorine and hydrogen cannot be exploded when rarefied only six times; and he generalises by supposing that rarefaction, whether produced by removing pressure or by heat, has the same effect.

I shall not begin by discussing the experiments of this ingenious author. My own results and conclusions are very different from his; and the cause of this difference will, I think, be obvious in the course of these inquiries. I shall proceed in stating the observations which guided my researches.

When hydrogen gas slowly produced from a proper mixture was inflamed at a fine orifice of a glass tube, as in the experiment called the philosophical candle, so as to make a jet of flame of about one-sixth of an inch in height, and introduced under the receiver of an air pump, containing from 200 to 300 cubical inches of air, the flame enlarged as the receiver became exhausted; and when the gage indicated a pressure between four and

five times less than that of the atmosphere was at its maximum of size, it then gradually diminished below, but burned above till the pressure was between seven and eight times less, when it became extinguished.

To ascertain whether the effect depended upon the deficiency of oxygen, I used a larger jet with the same apparatus, when the flame, to my surprise, burned longer, and when the atmosphere was rarefied ten times, and this in repeated trials. When the larger jet was used, the point of the glass tube became white hot, and continued red hot till the flame was extinguished. It immediately occurred to me, that the heat communicated to the gas by this tube was the cause that the combustion continued longer in the last trials when the larger flame was used; and the following experiments confirmed the conclusion. A piece of wire of platinum was coiled round the top of the tube, so as to reach into and above the flame. The jet of gas of one-sixth of an inch in height was lighted, and the exhaustion made; the wire of platinum soon became white hot in the centre of the flame, and a small point of wire near the top fused: it continued white hot till the pressure was six times less; when it was ten times it continued red hot at the upper part, and, as long as it was dull red, the gas, though extinguished below, continued to burn in contact with the hot wire, and the combustion did not cease until the pressure was reduced thirteen times.

It appears from this result, that the flame of hydrogen is extinguished in rarefied atmospheres, only when the heat it produces is insufficient to keep up the combustion, which appears to be when it is incapable of communicating visible ignition to metal; and as this is the temperature required for the inflammation of hydrogen at common pressures, it appears that its *combustibility* is neither

neither diminished nor increased by rarefaction from the removal of pressure.

According to this view with respect to hydrogen, it should follow, that amongst other combustible bodies, those which require least heat for their combustion ought to burn in more rarefied air than those that require more heat, and those that produce much heat in their combustion ought to burn, other circumstances being the same, in more rarefied air than those that produce little heat: and every experiment I have made confirms these conclusions. Thus olefiant gas, which approaches nearly to hydrogen in the heat produced by its combustion, and which does not require a much higher temperature for its inflammation, when its flame was made by a jet of gas from a bladder connected with a small tube furnished with a wire of platinum, under the same circumstances as hydrogen, ceased to burn when the pressure was diminished between ten and eleven times: and the flames of alcohol and of the wax taper, which require a greater consumption of heat for the volatilisation and decomposition of their combustible matter, were extinguished when the pressure was five or six times less without the wire of platinum, and seven or eight times less when the wire was kept in the flame. Light carburetted hydrogen, which produces, as will be seen hereafter, less heat in combustion than any of the common combustible gases, except carbonic oxyd, and which requires a higher temperature for its inflammation than any other, had its flame extinguished, even though the tube was furnished with the wire when the pressure was below one-fourth.

The flame of carbonic oxyd, which, though it produces little heat in combustion, is as inflammable as hydrogen, burned when the wire was used, the pressure being one-sixth.

 The

The flame of sulphuretted hydrogen, the heat of which is in some measure carried off by the sulphur produced by its decomposition during its combustion in rare air, when burned in the same apparatus as the olefiant and other gases, was extinguished when the pressure was one-seventh.

Sulphur, which requires a lower temperature for its combustion than any common inflammable substance, except phosphorus, burned with a very feeble blue flame in air rarefied fifteen times, and at this pressure the flame heated a wire of platinum to dull redness, nor was it extinguished till the pressure was reduced to one-twentieth *.

Phosphorus, as has been shown by M. Van Marum, burns in an atmosphere rarefied sixty times; and I found that phosphuretted hydrogen produced a flash of light when admitted into the best vacuum that could be made, by an excellent pump of Nairn's construction.

The mixture of chlorine and hydrogen inflames at a much lower temperature than that of hydrogen and oxygen, and produces a considerable degree of heat in combustion; it was therefore probable that it would bear a greater degree of rarefaction, without having its power of exploding destroyed; and this, I found in many trials, is actually the case, contrary to the assertion of M. de Grotthus. Oxygen and hydrogen, in the proportion to form water, will not explode by the electric spark when

* The temperature of the atmosphere diminishes in a certain ratio with its height, which must be attended to in the conclusions respecting combustion in the upper regions of the atmosphere, and the elevation must be somewhat lower than in arithmetical progression, the pressure decreasing in geometrical progression.

There is, however, every reason to believe, that the taper would be extinguished at a height of between nine and ten miles, hydrogen between twelve and thirteen, and sulphur between fifteen and sixteen.

rarefied

rarefied eighteen times; but hydrogen and chlorine, in the proportion to form muriatic acid gas, gave a distinct flash of light under the same circumstances, and they combined with visible inflammation when the spark was passed through them, the exhaustion being to one-twenty-fourth.

The experiment on the flame of hydrogen with the wire of platinum, and which holds good with the flames of the other gases, shows, that by preserving heat in rarefied air, or giving heat to a mixture, inflammation may be continued when, under common circumstances, it would be extinguished. This, I found, was the case in other instances, when the heat was differently communicated: thus, when camphor was burned in a glass tube, so as to make the upper part of the tube red hot, the inflammation continued when the rarefaction was nine times, whereas it would continue in air rarefied only six times, when it was burned in a thick metallic tube which could not be considerably heated by it.

By bringing a little naphtha in contact with a red hot iron it produced a faint lambent flame, when there remained in the receiver only one-thirtieth of the original quantity of air, though without foreign heat its flame was extinguished when the quantity was one-sixth.

I rarefied a mixture of oxygen and hydrogen by the air pump to about eighteen times, when it could not be inflamed by the electric spark. I then heated strongly the upper part of the tube till the glass began to soften, and passed the spark, when a feeble flash was observed not reaching far into the tube, the heated gases only appearing to enter into inflammation. This last experiment requires considerable care. If the exhaustion is much greater, or if the heat is raised very slowly *, it does not succeed;

* The reason will be obvious from what is stated in page 226.

succeed; and if the heat is raised so high as to make the glass luminous, the flash of light, which is extremely feeble, is not visible: it is difficult to procure the proper degree of exhaustion, and to give the exact degree of heat; I have, however, succeeded three times in obtaining the results, and in one instance it was witnessed by Mr. Brande.

To elucidate the enquiry still farther, I made a series of experiments on the heat produced by some of the inflammable gases in combustion. In comparing the heat communicated to wires of platinum by flames of the same size, it was evident, that hydrogen and olefiant gas in oxygen, and hydrogen in chlorin, produced a much greater intensity of heat in combustion than the other gaseous substances I have named burned in oxygen: but no regular scale could be formed from observations of this kind. I endeavoured to gain some approximations on the subject by burning equal quantities of different gases under the same circumstances, and applying the heat to an apparatus by which it could be measured. For this purpose a mercurial gas holder was furnished with a system of stop cocks, terminating in a strong tube of platinum, having a minute aperture. Above this was fixed a copper cup filled with olive oil, in which a thermometer was placed. The oil was heated to 212° to prevent any differences in the communication of heat by the condensation of aqueous vapour; the pressure was the same for the different gases, and they were consumed as nearly as possible in the same time, and the flame applied to the same point of the copper cup, the bottom of which was wiped after each experiment.

The results were as follows:

The flame from olefiant gas raised the thermometer to 270°

——————— hydrogen 238

 The

The flame from sulphuretted hydrogen	....	232°
——— coal gas	....	236
——— gaseous oxyd of carbon	....	218

The quantities of oxygen consumed (that absorbed by the hydrogen being taken as 1) would be, supposing the combustion perfect, for the olefiant gas 6, for the sulphuretted hydrogen 3, for the carbonic oxyd 1. The coal gas contained only a very small proportion of olefiant gas; supposing it to be pure carburetted hydrogen, it would have consumed four of oxygen. Taking the elevations of temperature, and the quantities of oxygen consumed as the data, the ratios of the heat produced by the combustion of the different gases, would be for hydrogen 26, for olefiant gas 9.66, for sulphuretted hydrogen 6.66, for carburetted hydrogen 6, for carbonic oxyd 6*.

It will be useless to reason upon this ratio as exact, for charcoal was deposited both from the olefiant gas and coal gas during the experiment, and much sulphur was deposited from the sulphuretted hydrogen; and there is great reason to believe, that the capacities of fluids for heat increase with their temperature. It confirms, however, the general conclusions, and proves that hydrogen stands at the head of the scale, and gaseous oxyd of carbon at the bottom. It might at first view be imagined that, according to this scale, the flame of carbonic oxyd ought to be extinguished by rarefaction, at the same degree as that of carburetted hydrogen; but it must be remembered, as I have mentioned in another place, that carbonic oxyd is a much more combustible gas. Carbonic oxyd inflames in the atmosphere when brought

* These results may be compared with Mr. Dalton's new System of Chemical Philosophy; they agree in showing that hydrogen produces more heat in combustion than any of its compounds.

into

into contact with an iron wire heated to dull redness, whereas carburetted hydrogen is not inflammable by a similar wire, unless it is heated to whiteness so as to burn with sparks.

II. *On the Effects of Rarefaction by Heat on Combustion and Explosion.*

The results detailed in the preceding section are indirectly opposed to the opinion of M. de Grotthus, that rarefaction by heat destroys the combustibility of gaseous mixtures. Before I made any direct experiments on this subject, I endeavoured to ascertain the degree of expansion which can be communicated to elastic fluids by the strongest heat that can be applied to glass vessels. For this purpose I introduced into a graduated curved glass tube some fusible metal. I heated the fusible metal, and the portion of the tube containing the air included by it, under boiling water for some time. I then placed the apparatus in a charcoal fire, and very gradually raised the temperature till the fusible metal appeared luminous when viewed in the shade. At this time the air had expanded so as to occupy 2.25 parts in the tube, it being 1 at the temperature of boiling water. Another experiment was made in a thicker glass tube, and the heat was raised until the tube began to run together; but though this heat appeared cherry red, the expansion was not to more than 2.5,[1] and a part of this might perhaps have been apparent only, owing to the collapsing of the glass tube before it actually melted. It may be supposed that the oxydation of the fusible metal may have had some effect in making the expansion appear less; but in the first experiment the air was gradually brought back to its original temperature of boiling water, when the absorption was scarcely sensible. If M. Gay Lussac's

conclusions be taken as the groundwork of calculation, and it be supposed that air expands equally for equal increments of temperature, it would appear that the temperature of air capable of rendering glass luminous must be 1035° Fahrenheit *.

M. de Grotthus describes an experiment in which atmospheric air and hydrogen, expanded to four times their bulk over mercury by heat, would not inflame by the electric spark. It is evident, that in this experiment a large quantity of steam or of mercurial vapour must have been present, which, like other inexplosive elastic fluids, prevents combustion when mixed in certain quantities with explosive mixtures; but though he seems aware that his gases were not dry, yet he draws his general conclusion, that expansion by heat destroys the explosive powers of gases, principally from this inconclusive experiment.

I introduced into a small graduated tube over well-boiled mercury, a mixture of two parts of hydrogen and one of oxygen, and heated the tube by a large spirit lamp till the volume of the gas was increased from 1 to 2.5. I then, by means of a blow pipe and another spirit lamp, made the upper part of the tube red hot, when an explosion instantly took place.

I introduced into a bladder a mixture of oxygen and hydrogen, and connected this bladder with a thick glass tube of about one-sixth of an inch in diameter and three feet long, curved so that it could be gradually heated in a charcoal furnace; two spirit lamps were placed under

* The mode of ascertaining temperatures as high as the point of fusion of glass by the expansion of air, seems more unexceptionable than any other. It gives for the point of visible ignition nearly the same degree as that deduced by Newton from the times of the cooling of ignited metal in the atmosphere.

 the

the tube where it entered the charcoal fire, and the mixture was very slowly pressed through; an explosion took place before the tube was red hot.

This experiment shows that expansion by heat, instead of diminishing the combustibility of gases, on the contrary, enables them to explode apparently at a lower temperature, which seems perfectly reasonable, as a part of the heat communicated by any ignited body must be lost in gradually raising the temperature. I made several other experiments which establish the same conclusions. A mixture of common air and hydrogen was introduced into a small copper tube, having a stopper not quite tight; the copper tube was placed in a charcoal fire; before it became visibly red an explosion took place, and the stopper was driven out.

I made various experiments on explosions by passing mixtures of hydrogen and oxygen through heated tubes; in the beginning of one of these trials, in which the heat was much below redness, steam appeared to be formed without any combustion. This led me to expose mixtures of oxygen and hydrogen in tubes, in which they were confined by fluid fusible metal, to heat; and I found that by carefully applying a heat between the boiling point of mercury, which is not sufficient for the effect, and a heat approaching to the greatest heat that can be given without making glass luminous in darkness, the combination was effected without any violence, and without any light: and commencing with 212°, the volume of steam formed at the point of combination appeared exactly equal to that of the original gases. So that the first effect in experiments of this kind is an expansion, afterwards a contraction, and then the restoration of the primitive volume.

If when this change is going on, the heat be quickly raised to redness, an explosion takes place; but with small quantities of gas the change is completed in less than a minute.

It is probable, that the slow combination without combustion, already long ago observed with respect to hydrogen and chlorine, oxygen and metals, will happen at certain temperatures with most substances that unite by heat. On trying charcoal, I found that at a temperature which appeared to be a little above the boiling point of quicksilver, it converted oxygen pretty rapidly into carbonic acid, without any luminous appearance; and at a dull red heat, the elements of olefiant gas combined in a similar manner wlth oxygen, slowly and without explosion.

The effect of the slow combination of oxygen and hydrogen is not connected with their rarefaction by heat, for I found that it took place when the gases were confined in a tube by a fusible metal rendered solid at its upper surface; and certainly as rapidly, and without any appearance of light.

M. de Grotthus has stated, that, if a glowing coal be brought into contact with a mixture of oxygen and hydrogen, it only rarefies them, but does not explode them; but this depends upon the degree of heat communicated by the coal: if it is red in day-light, and free from ashes, it uniformly explodes the mixture; if its redness is barely visible in shade, it will not explode them, but cause their slow combination: and the general phenomenon is wholly unconnected with rarefaction, as is shown by the following circumstance. When the heat is greatest, and before the invisible combination is completed, if an iron wire, heated to whiteness, be

placed upon the coal within the vessel, the mixture instantly explodes.

Light carburetted hydrogen, or pure fire-damp, as has been shown, requires a very strong heat for its inflammation; it therefore offered a good substance for an experiment on the effect of high degrees of rarefaction by heat on combustion. I mixed together one part of this gas and eight parts of air, and introduced them into a bladder, furnished with a capillary tube. I heated this tube till it began to melt, and then slowly passed the mixture through it into the flame of a spirit lamp, when it took fire, and burned with its own peculiar explosive light beyond the flame of the lamp; and when withdrawn, though the aperture was quite white hot, it continued to burn vividly.

That the compression in one part of an explosive mixture produced by the sudden expansion of another part by heat, or the electric spark, is not the cause of combination, as has been supposed by Dr. Higgins, M. Berthollet, and others, appears to be evident from what has been stated, and it is rendered still more so by the following facts. A mixture of hydro-phosphoric gas (biphosphuretted hydrogen gas) and oxygen, which explode at a heat a little above that of boiling water, was confined by mercury, and very gradually heated on a sand-bath: when the temperature of the mercury was 242°, the mixture exploded.

A similar mixture was placed in a receiver communicating with a condensing syringe, and condensed over mercury till it occupied only one-fifth of its original volume. No explosion took place, and no chemical change had occurred, for when its volume was restored, it was instantly exploded by the spirit lamp.

It

It would appear, then, that *the heat* given out by the compression of gases is the real cause of the combustion which it produces; and that at certain elevations of temperature, whether in rarefied or compressed atmospheres, explosion or combustion occurs, *i. e.* bodies combine with the production of heat and light.

TO BE CONCLUDED IN OUR NEXT.

On raising Oaks. By her Grace the Duchess of RUTLAND, *of Belvoir Castle. Communicated by Mr.* MATTHEW POUND, *her Grace's Woodman.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Gold Medal was voted to her Grace for this Improvement.

MR. Pound, on behalf of her Grace the Duchess of Rutland, as a candidate for a premium for ascertaining the best method of raising oaks, agreeably to the rules of the Society of Arts, &c. premium No. 5, for the year 1815, was directed by her Grace to communicate to the Society the following comparative experiments on the best method of raising oaks, and which have been adopted in the nurseries and land set apart for the purpose, under her immediate inspection.

No. I.—In respect to the best method of raising and growing oaks for timber, the following offers itself, and which has been successfully tried on her Grace's land. Previous to sowing the acorn the land was pared and burnt and buck-wheat sown the first year: the second year (1807) the acorns were sown in drills, three feet apart, after the land had been once ploughed; the rows were

were hoed the two first years: the third, fourth, and fifth years potatoes were planted between the rows, one row only between each row of oaks: the second, third, and fourth years the trees were thinned to two feet apart in the rows; the third crop of potatoes being one year after the last thinning. The next year, being the sixth year after sowing the acorns, the potatoe crop ceased, as the branches had formed too much shade: had not this been the case, the potatoe crop would have been continued, as the principal object in view is to keep up a continual *smothering crop,* until the oaks become *such* themselves: after that period, there is nothing to impede a most rapid growth, forming straight, clean, handsome bolls; and, by proper attention to thinning at certain periods, soon become a valuable plantation of superior oaks. These oaks having been sown only eight years, many of them are *eleven* feet high, and *ten* inches in circumference; and so fine and clean in their growth, that every judge who sees them is surprised at their progress; and this is certainly owing to the method pursued.

No. II.—The second comparative experiment was made on *grass land.* The land was ploughed *once,* and the acorns sown in drills, five feet apart, and hoed the two first years; after this period, there was nothing more done than to cut down the tall weeds with a reaping-hook once in each year, for four years; these trees were thinned to three feet apart in the rows, after the second, third, and fourth years of their growth. These trees were sown in 1808, and are now six feet high, of a healthy strong appearance, but not so fine as No. I. by a very great difference, and are not likely to advance so rapidly.

No. III.—The third comparative experiment was by planting; the land was previously ploughed and sown with

with buck wheat. The land being clean, no weeds had arisen through the winter; this piece of land was about seven acres, and it was desirable to plant the whole with oaks. Having a quantity of two and three years seedling oaks, both in nursery beds and in drills, I was induced, through the lateness of the season, and scarcity of hands, to plant these oaks *with the plough;* this so far succeeded, that in six days I had planted about half the land with about 100,000 oaks in rows, at three feet distance, and one foot plant from plant. My object in planting one foot plant from plant was, to grow them from two or three years, then to thin them to three feet, which has been done; they now stand three feet apart, or thereabouts. These trees were hoed the two first summers, since which nothing has been done but thinning them to three feet, and cutting down the tall weeds once in the year for the four years after. This is now a very healthy thriving plantation, and has every appearance of making a good oak wood, the plants being on an average four feet high.

No. IV.—The fourth comparative experiment was made on the remaining half of the above-mentioned seven acres, and planted in every respect the same way, with only this difference, namely, the acorns were sown in the year 1808 in the nursery, in beds, the common way. From the bad opinion I had of raising oaks in nursery beds, and then quartering them out for two, three, or four years, previous to making them into a plantation, induced me to try this method, which has fully answered my expectation. These oaks on an average are three feet high, and perfectly healthy; they will, no doubt, make a good oak wood. Their not being higher than three feet must be attributed to their having been raised in nursery beds, which

which rendered them, *when planted,* more weak and delicate than those raised *in drills.* So fully convinced am I of this, that I now sow all in drills.

No. V.—In the fifth comparative experiment, two acres were planted with oaks *only,* at four feet distance each way; this was done by digging holes, and planting the seedling plants, at three years old, one plant in each hole; these plants were the thinnings of No. I. The land was allowed to be planted by poor persons with potatoes, one row *only* between each row of oaks; this practice has been followed for three years, and the oaks have so increased in their growth as almost to exclude the air from the potatoes, and will next year become compleat *smothering* crop. This desirable circumstance has been effected with *oaks only,* without a mixture of any other trees, in four years; and there is no doubt, that the plants will advance at a most rapid rate, many of this year's shoots being two feet long, and the plants in general seven feet high.

From the observations I have been able to make from the above experiments, I consider the *first* and the *last methods* as the best: the first method, No. I, is by sowing the acorns where they are to remain, and after hoeing the rows two years, to plant potatoes, one row only between each row of oaks, for three years; decidedly in my opinion the *best method,* as the facts themselves will prove. The benefit of the oaks from planting potatoes is incalculable; for, from the above experiments, and from others made at the same time, and with the same seedling oaks, planted with a mixture of larch, spruce, beech, birch, and other forest trees, and also with oaks only, in all cases I have found that potatoes between the rows are so superior to all other methods, that the oaks will actually grow

grow as much the first four years with them as in six without them.

It appears, then, that the great secret in raising plantations of oaks is, to get them to advance rapidly the first eight years from seed, or the first five years from planting, so as the heads of the trees are completely united and become a *smothering crop:* after this is effected, the trees will strive to outgrow each other, and will advance in height rapidly; they will be clean straight trees, to any given height: experiments have proved the fact, which may be verified by viewing Belvoir.

How easy is it then to have fine plantations for oaks *only*, without mixture, as the *smothering crop* can be produced the third year after sowing the acorns, and the first year after planting, by *the potatoe crop,* until the oaks themselves become a smothering crop. If the seedlings are carefully thinned, and as carefully planted, all doubts of obtaining a fine plantation of oaks are at an end. By the method of planting I have described, I have found that not more, on an average, than one in five hundred die.

I beg leave to state particularly to the Society, that the foregoing experiments of growing oaks only, without a mixture of other forest trees, were made with a view to controvert the opinion generally, I believe, entertained, that a good oak plantation could not be raised or obtained without a mixture of firs or other trees to shelter or protect them in their infant state, as it appeared evident to me, from the plantations around Belvoir, that the oaks were uniformly *worse* in the mixed plantations than in those of *oak only.* Oaks, in my opinion, are much injured by any, or all sorts of trees growing near them, and therefore are not *ultimately* promoted in their growth by being planted in mixed plantations.

The annexed Certificate, signed by experienced and respectable nurserymen and gardeners, who have viewed the whole of the plantations mentioned in my communication, will shew the condition they are in, and that what is stated is correct.

Any further explanation which may be deemed necessary will be readily furnished, by addressing a line to me, Matthew Pound, nurseryman, Belvoir Castle, near Grantham, Lincolnshire.

Certificate.

We, the undersigned, having viewed the plantations referred to in the preceding report, do hereby certify, that they are healthy in every respect as stated; particularly No. I, in which the trees are very fine, clean, and large, much larger than any we have seen of their age; and it is our opinion, that this has been effected by the treatment pursued, which appears to us to be the best method of raising oak timber: the whole are well fenced with posts, and rails, and young hawthorn hedges, planted the common way with ditches.

(Signed)

The Rev. Sir John Thoroton.
William Wood, Nurseryman, Grantham.
William Wood, Jun. ditto, ditto.
William Dolby, Gardener to Sir W. E. Welby, Bart. Denton.

On

On the mechanical Structure of Iron developed by Solution, and on the Combinations of Silex in Cast Iron.

By J. F. DANIELL, *Esq. F. R. S. and M. R. I.*

Extracted from the JOURNAL of SCIENCE and the ARTS.
Edited at the ROYAL INSTITUTION.

IN prosecuting my inquiries into the resistance which mechanical structure offers to chemical action, I have been led to bestow considerable attention upon the difference of the molecular arrangement of various kinds of iron. No subject stands more in need of illustration, nor is there any, perhaps, which is more likely to lead to useful practical results, than one which concerns a substance of such primary importance to the arts.

I have failed to produce regular crystals in iron, by the means which I have successfully employed with the more brittle metals; but that, under certain circumstances, it does assume such forms, is fully demonstrated, by some observations of Dr. Wollaston, upon a mass of native iron, found in Brazil, which have been published in the last volume of the Philosophical Transactions (1816). From this Paper I shall make a short extract, for the double purpose of indicating the form of the crystals, and of confirming the general accuracy of my observations upon the resistance of crystalline arrangement to chemical action, by his authority. I am the more happy in being enabled to do this, as I have had but too much reason to suppose that my experiments had failed to produce conviction, where it was so much to be desired.

"The specimen of the iron with which Mr. Mornay very liberally supplied me for experiment, though it necessarily bears marks of the hammer by which it has been detached, presents also other surfaces, not only indicat-

ing that its texture is crystalline, but showing also the forms in which it is disposed to break, to be those of the regular octohedron and tetrahedron, or rhomboid, consisting of these forms combined. In my own specimen, *the crystalline surfaces appear to have been the result of a process of oxydation, which has penetrated the mass to a considerable depth in the direction of its laminæ;* but in the specimen which is in the possession of the Geological Society, the brilliant surfaces that have been occasioned by forcible separation from the original mass, exhibit also the same configurations as are usual in the fracture of octohedral crystals, and are found in many simple native metals."

This spontaneous decomposition of the metal in the direction of its crystalline laminæ, is a new and valuable fact in the chain of evidence; and I have myself since observed an analogous instance of similar disintegration. In crossing the Alps, in the course of last summer, I remarked that the veins of carbonate of lime, which run in the mica slate, had their surfaces, which were exposed to the action of the atmosphere, *weathered* into distinct and well defined rhomboids.

But to return to our subject. Although mathematical solids were not discovered by a solution of iron, yet a difference of structure was plainly discernible in the different varieties submitted to the experiment, which is well worthy of attention.

A cube of *gray cast iron,* of a granular fracture, was immersed in diluted muriatic acid. When the acid was saturated, it was taken out and examined. The size of the cube did not appear to be at all diminished, owing to a soft spungy substance, which had not been acted upon. This was easily cut off in large flakes, with a knife. Of this substance I shall have occasion to say more hereafter.

The

The texture of the iron, of course, could not be learnt for this covering. But the metal having been submitted to repeated solution, the quantity of the residuary matter gradually decreased, and the surface being scrubbed with a brush, was found to be covered with small irregular ridges, which, when examined with a magnifier, presented the appearance of bundles of minute needles.

A mass of *bar iron*, which had undergone all the operations of *puddling* and *rolling*, was next submitted to the experiment. When the acid was saturated, it presented the appearance of a bundle of fasces, the fibres of which it was composed, running in a parallel and unbroken course throughout its length. At its two ends, the points were perfectly detached from one another, and the rods were altogether so distinct, as to appear to the eye to be but loosely compacted.

The next subject of examination was a specimen of *white cast iron*, of a radiated fracture. The first thing worthy of remark was, that it took just three times as long to saturate a given portion of acid as the two preceding specimens. Its texture, when examined, differed very much. It appeared to be composed of a congeries of plates, aggregated in various positions, sometimes producing stars upon the surface, from the intersection of their edges. It exhibited altogether a very crystalline appearance, but no regular facts were discoverable.

A small bar of *cold short iron* was next selected; it was exceedingly brittle, and its fracture presented bright and polished surfaces much resembling antimony. Its texture, however, when subjected to solution proved to be fibrous, but not so perfectly so as the first specimen of bar iron. The course of the fibres was very much broken, the acid having dissolved out small cavities which cut them short. It was a square bar, and the alternate sides

were

were more acted upon than the others, so that the fibres would moreover appear to have been flattened.

A rod of *hot short iron* presented at the end of the operation, a closely compacted mass of very small fibres, perfectly continuous. The congeries was twisted, but the threads preserved their parallelism. A portion of gun-barrel was submitted to the experiment. The metal was remarkably free from particles of an extraneous nature. The texture proved to be fibrous, but the threads were not regular or straight. They were generally disposed in waved lines, and the whole together was very compact.

A mass of steel, just taken from the crucible in which it had been fused, was subjected to the action of muriatic acid. It was of a radiated texture, the upper surface being marked with rays which proceeded from the centre to the circumference. It was readily acted upon by the solvent, and when withdrawn, presented a highly crystalline arrangement. It appeared to be entirely composed of very bright and minute plates which reflected the light in every direction. The laminæ were very thin, and there was no order discoverable in their mutual positions.

A specimen of cast steel, which had been subjected to the action of the tilting hammer of a very fine white granular fracture, was next examined. It was not easily acted upon, even by strong muriatic acid, and it required the addition of a small quantity of nitric acid to effect its decomposition. When the acid was saturated, the metal still presented a compact appearance; nothing of a fibrous structure was visible; but in one or two places where the acid had acted with most energy, it had detected the edges of laminæ, which appeared to form plates of the extent of the whole surface.

The blade of a razor composed of Wootz steel presented

sented the same appearance, differing in nothing except three large notches in the back at right angles to the edge.

The blade of a razor of an inferior description presented a fibrous texture of waving lines. Deep notches in the back similarly placed were likewise visible in this. It was sufficiently evident, that the fibrous texture of this razor was owing to the admixture of iron, and to the imperfection of the process for converting it into steel.

A bar of steel, of an even granular fracture, was broken into two. The two pieces were heated in a furnace to a cherry red. In this state one of them was plunged into cold water, and the other allowed very gradually to cool by the slow extinction of the fire. They were then both placed in muriatic acid, to which a few drops of nitric acid had been added. The last was readily attacked, but it required five fold as much time to effect the saturation of the acid of the first. When the solvents had ceased to act they were both examined. The tempered steel was exceedingly brittle, its surface was covered with small cavities, like worm-eaten wood, but its texture was very compact, and not at all striated. The untempered steel was easily bent, and not elastic, and it presented a fibrous and wavy texture.

I am inclined to hope that these observations may not be without interest, and that, if properly followed up, they may lead to some useful practical results. We find that the excellence of iron for mechanical purposes, depends upon its fibrous texture. The raw material, as we may term the crude cast iron, is better fitted for working in proportion as it approaches to this texture. We can trace a strong analogy between it and other fibrous substances. In flax and hemp the fibres are carefully separated from the other constituent parts of the vegetables by putrefaction and beating. In iron, the parts

which

which are not fibrous are thrown off by a species of fermentation, called puddling and hammering. In the former, the fibres are interlaced with one another by tearing them into short pieces, and by a species of carding. In the latter, the same purpose is effected by cutting the bars into short pieces repeatedly, tying them in bundles, and again welding them together. The vegetable fibres are spun out into lengths, and are found to be tenacious, and fitted for use. The fibres of the metal are likewise drawn out by rolling, and their acquired toughness, adapts them to the purposes of the arts.

Might not the same twisting of the threads, which is found to give compactness and strength to hemp and flax, be employed with advantage to increase the tenacity of the particles of iron? Is there not something analogous to this in the waved structure of the gun-barrel, which is known to be particularly tough? And may not the superior quality of the Damascus sword blades, which is still a problem to our manufacturers, be owing to some such management? Their structure would answer exactly to the idea of small rods of iron and steel welded and twisted together, and afterwards beat out. The experiment is worth the trial.

The good qualities of steel seem to depend for different purposes upon a varying mechanical arrangement of its particles. This difference of structure is conferred by certain regulations of temperature. We find that the same bar of metal suddenly cooled from a high temperature is possessed of a quite different texture, and different mechanical properties, from those which characterise it when gradually lowered. May not the qualities of cast iron vary also with the rate of cooling? and might not a proper regulation of heat improve the fibrous texture, or even confer a certain degree of malleability?

I proceed

I proceed now to a very different species of investigation, into which I was naturally led, while prosecuting the preceding experiments. I have mentioned above, that in dissolving the cube of gray cast iron, a porous spongy substance was left untouched by the acid. This was easily cut off with a knife. It was of a dark gray colour, somewhat resembling plumbago. Some of it was put to dry on blotting-paper, and in the course of a minute spontaneously heated and smoked. In one instance, when a considerable quantity had been heaped together, it ignited, and scorched the paper. Its properties were not impaired by being left for days and weeks in the solution of iron, or in water. I left some for three months covered with a solution of sulphate of iron, and exposed in an open dish to all the changes of the weather. At the expiration of that time, red oxyd of iron had been deposited from the sulphate, but the black matter, when collected upon blotting-paper, raised the thermometer twenty degrees. Muriatic and sulphuric acid both extracted the substance. When nitric acid was used, the plumbaginous matter was produced, but no longer heated in the air. I immediately commenced a series of experiments for the purpose of ascertaining the nature of a body which presented such a curious anomaly.

A portion of it, just prepared, was placed in a shallow dish upon the water-trough, and a bell glass of common air inverted over it. The water gradually rose, and the residue of the air being examined at the end of twenty-four hours, it was found that the oxygen had been totally absorbed.

Another portion was put into a retort to which a stopcock had been adapted. The air was exhausted, and the moisture allowed to evaporate. Oxygen gas was then admitted. It became very hot, and the gas was absorbed,

 There

There was no change of appearance in either experiment. In chlorine it also became very hot, and a yellow liquid formed. This was washed out. A black powder was left of a high metallic lustre, resembling plumbago. The solution was precipitated with ammonia, and afforded nothing but black oxyd of iron.

After the residue of the iron had absorbed its dose of oxygen it was heated to redness, and digested in muriatic acid, to take up all the oxyd of iron with which it was necessarily mixed. When well washed and dried, it exactly resembled that which had been prepared with chlorine; 320 grains afforded 95.6 of the metallic powder.

The muriatic solution was precipitated by ammonia. The precipitate was boiled with a little nitric acid, and heated to redness. It weighed 166.8.

Muriate of barytes was poured into the solution of muriate of ammonia, from which the oxyd of iron had been collected, and a dense white precipitate of sulphate of barytes was formed, weighing, when washed and dried, 178.4.

From these preparatory experiments then, we learn, that the residue of the cast iron, after the action of sulphuric acid, heats in consequence of its uniting with the oxygen of the air; and this residue, after it has so absorbed oxygen, is composed of

Oxyd of iron	166.8
Sulphuric acid	60.4
Gray substance, with metallic lustre	95.6
	322.8

The increase of weight being probably owing to the higher oxygenation of some of the iron, by boiling in nitric acid.

TO BE CONCLUDED IN OUR NEXT.

Analysis

Analysis of Rice. By M. H. Bracconot.

From the Annales de Chimie et de Physique.

As rice has never yet been analyzed, and as it is a grain of much importance, being a principal article of food to a great part of the human species, I have thought it my duty to make it the subject of some experiments, Parmentier is, I believe, the only person who has made experiments upon rice. The results he obtained led him to rank it as a particular substance between starch and gum, doubtless on account of its horny demi-transparency, and the difficulty of reducing it to a powder, which has not the tenuity, the sound, nor the feel of starch, and which, besides, precipitates quickly to the bottom of the vessel when diluted with water; but we shall see that this cereal grain is more complex than may be imagined.

Action of Water upon Rice.—100 grammes of Carolina rice lost by dessication five grammes of moisture; it was afterwards macerated with water at a temperature of 50° c. The grain absorbed the water with avidity, and opened almost immediately in several transverse sections; this would not have taken place so speedily if the rice had not been previously well dried. The grain thus opened was easily crushed between the fingers into a powder extremely tenuous. It was then bruised in a glass mortar, and the liquid in which it had macerated was added successively: the result was a milky liquor, which was thrown upon a filter. The greatest part of the substance of the rice remained upon the filter; well washed with water, in order to separate all the parts that were soluble; then well dried; it weighed 93 g. 67. The water it was washed in

was set aside to be examined. The 93 g. 67, diluted with water, passed entirely through a silk sieve; but the milky liquor contained at least two distinct substances: one very white, making about two-thirds of the total weight, remained for some time in suspension in the liquid; the other, less white, was specifically heavier: it was easily separated from the first, by the affusion of a great quantity of water, and by successive decantations of the emulsive liquid. This deposited, at the end of a few days, a very white substance, which had acquired a sort of density by the approximation of its molecules: when dried it was of a dazzling white, light, easily reduced to an impalpable powder, that adhered to the fingers with facility, and gave out a peculiar sound by pressure.

This powder, bruised with water and a little iodine, gave a fine deep blue, as starch would do. It dissolved in boiling water, and on cooling the result was a trembling demi transparent glue, exactly resembling diluted starch. If one part of the same powder be boiled with four thousand parts of water, and the liquid be filtered after cooling, it passes as limpid as water; by pouring into it lime water, barytes water, it gathers in time to a white flaky precipitate. The infusion of gall in it also forms a light precipitate. Common starch, treated in the same manner, gives similar results, which proves, that when it is made it is to a certain point soluble in cold water, and that the re-agents above specified detect very small quantities of it; this portion of rice then is manifestly starch. As for the other substance, more heavy than the fecula, and which was first deposited, it was formed of a great quantity of starch, united to a vegeto-animal matter, and to a *parenchyme*: we shall examine it presently.

Examination

Examination of the soluble Matters which Water separates from Rice. — The waters which had served to take from 100 grammes all the parts that were susceptible of dissolving in them, were acid, and reddened the paper dyed blue by turnsol. Suspecting that this free acid might be of the nature of vinegar, those waters were put together and distilled in a glass retort; the product, mixed with a very small quantity of barytes water, and then evaporated to dryness, left only a light residuum, but from which weakened sulphuric acid disengaged the smell of acetic acid. During the progress of the distillation the liquor in the retort became turbid, especially towards the end, and it collected into a white matter, rather divided, which did not appear to be albumen. The evaporation of this liquor, with its sediment, was accomplished in a small porcelain capsula, and there remained a residuum, tolerably dry, of a pale yellow, slightly attracting the moisture, and weighing 1 g. 28: it was treated with a small quantity of warm water, to give it the consistence of a syrup, and then some alcohol was poured into it; it formed an abundant deposit, which, with the aid of a gentle heat, collected into a mass of a gummy appearance, which yielded between the fingers: it weighed 0 g. 99. The alcohol which had precipitated this matter was evaporated at a gentle heat, and left 0 g. 29 of a syruppy residuum, little coloured, very difficult to dry, of a sugary taste, and the smell of honey, attracting moisture like incrystallisable sugary matter, little soluble in alcohol, and burning brightly, spreading at the same time an odour of barley-sugar. I presumed that this sugary matter contained some acetate of potash, which contributed to render it deliquescent; but it appeared to retain traces only of muriate of potash, for having

having poured sulphate of silver into its solution, it formed a light precipitate of chlorine of silver; the liquor evaporated, then treated with phosphoric acid by the aid of heat, exhaled only acetic vapour.

The mass of a gummy appearance, precipitated by alcohol, and weighing 0 g. 99, was digested with cold water: the greatest part of it dissolved, with the exception of a white flaky matter, which the filter afterwards separated from the liquor: when well dried upon the filter, the weight of which was known, it weighed 0 g. 13, and preserved its whiteness. A small quantity of this matter being put into a glass tube, closed at one extremity, was exposed to heat, to determine a commencement of decomposition: a paper dyed by turnsol, and restored to a red colour by an acid when plunged in the air of the tube, immediately resumed the blue colour.

The charcoal of this matter incinerated, left a remarkable quantity of phosphate of lime; it did not dissolve in boiling distilled vinegar, nor in hydrochloric acid, diluted with water. A slight solution of potash, heated slightly with this substance in a silver capsula, did not appear to have a very decided action upon it; it only partly decomposed it, and it was observed, that whereever this matter came in contact with the capsula it formed black stains, evidently caused by the presence of sulphur. This matter is of a vegeto-animal nature: we shall return to it by examining the action of weakened sulphuric acid upon rice.

The gummy solution, separated from the matter of which we have been speaking, appeared still to retain some traces of it, for it was not perfectly transparent, and had an opaline aspect; it contained phosphate of lime,

lime, which ammonia precipitated, and which was probably held in solution in it, by means of a little acetic acid; it appeared also to retain traces of phosphate of potash; for if, after precipitating the phosphate of lime, a little hydrochlorate of lime or sulphate of iron was added to the liquor saturated with ammonia, it formed, by repose, a new phosphated precipitate.

In order to separate the substances of the gummy matter, acetate of lead was poured into its solution; the precipitate that resulted, decomposed by sulphuric acid, gave an incrystallisable acid, mixed with vegeto-animal matter. A portion of this acid exposed to fire yielded a charcoal which, treated with the blow-pipe, left a considerable globula of vitreous limpid phosphoric acid. Another portion of the same acid, saturated with potash, and exposed to the fire, left an alkaline residuum, which indicated slight traces of a combustible acid. Into the liquor, separated from the precipitate formed by the acetate of lead, was poured carbonate of ammonia; it was then filtered, and evaporated to dryness; there remained 0g. 71 of a matter very little coloured, transparent, shining, of a vitreous fracture, and which had absolutely the appearance of a gum, although it had not entirely the insipidity.

Exposed upon burning coal it swelled, and spread an odour of burnt bread; submitted to distillation, it gave oil, and a considerable acid product, which did not appear to contain ammonia; however, the infusion of gall nuts precipitated the solution of this gummy matter in water; it was also precipitated by lime water in large white flakes, soluble in distilled vinegar. Barytes water also produced a white flaky deposit; acetate of lead made no change in it; but sub-acetate of lead and protoxidated nitrate

nitrate of mercury formed slight precipitates. Although this matter had entirely the external aspect of gum, its chemical properties seemed to me to approach more to those of starch. It is true, that it is easily soluble in cold water, and starch is not, at least in its ordinary state; but we know that it will become so after a slight modification, and I am satisfied that the gummiform matter, soluble in water, that is obtained from starch slightly torrified, has much analogy with the gummy matter of rice: like this latter, its solution is precipitated by tannin, lime water, barytes water, but not by acetate of lead, and it also yields, by distillation, a product which contains no ammonia. This gummy matter, so similar to starch, exists probably in most other grains which contain this latter substance.

Action of weakened sulphuric Acid upon Rice; Separation of the Starch, the Parenchyme, and the Vegeto-animal Matter.

According to what we have above related, rice, when well dried and immersed in warm water, begins to soften at the point, when it can be easily crushed, and, on being diluted with water, forms a milky liquor, which yields two distinct deposits, the most considerable of which is formed of starch; the other, more heavy and of another shade, contains also a great quantity of starch, besides the vegeto-animal matter which remains attached to the *parenchyme*, which it is difficult to separate by reason of its great division. To attain this end, and to determine the respective quantities of these matters, 100 grammes of Carolina rice, whole, was put to macerate in water at 50° c. being previously well dried; it was then boiled for about half an hour in water sharpened with sulphuric acid; the amilaceous matter entered into solution, and the *parenchyme* remained in membranes or

 floating

floating shreds in the liquor, and were separated by passing them boiling through fine linen. In cooling it left a deposit of very divided matter, having the appearance of a semi-transparent jelly, and which was separated by filtering the liquor through paper. This acid liquor, containing starch, boiled for several hours, and suitably treated, gave a syrup, which in time consolidated into a mass of sugar. The gelatinous mass remaining on the filter was of considerable bulk; washed with a great quantity of water, and then dried, it weighed 3 g. 6, and was of a horny semi-transparency. Put in ebullition with water it swelled, but without dissolving, at least in any appreciable manner; however, the liquor was slightly precipitated in white flakes by the gall infusion. Slightly heated in a silver capsula, with a solution of potash, the vessel was very much blackened, as if hydrosulphate had been poured into it. Diluted ammonia, macerated at a gentle heat with this substance, easily dissolved without decomposing it. An acid poured into the liquor formed an abundant deposit of the dissolved matter, but no hydro-sulphurous odour was disengaged. Hydro-chloric acid, diluted with water, and boiled with the same matter, dissolved but very trifling quantities, which were precipitated by ammonia. The insoluble matter, separated from the acid liquor, and well washed with warm water, then put in ebullition with this liquid, was entirely dissolved into what appeared to be a neutral hydro-chloric combination sufficiently permanent, which was not affected by ammonia, but in which an excess of hydro-chloric acid determined a considerable white precipitate: the supernatant liquor was as limpid as water. On distillation it furnished a great quantity of yellowish concrete oil, a liquid slightly alkaline, which restored the blue

 colour

colour to paper dyed red with turnsol, and which contained hydro-sulphate of ammonia, for acetate of lead formed a brown precipitate in it, but it did not sublime with carbonate of ammonia. We see by the properties of this vegeto-animal matter, that it is the same as what we obtained, although in a small quantity, from the lessive waters of the rice, with this difference only, that it does not sensibly contain phosphate of lime. It is less azoted than gluten and albumen. I return now to the *parenchyme* of the rice remaining upon the linen; when well washed it was of a dead white, like cheese, and spread uniformly between the fingers, without adhering; when dried it weighed 4 g. 8, and preserved its white colour, only it had a semi-transparency, owing to the presence of an oily matter, which penetrated it, especially in that proceeding from the rice of Piémont. Exposed to the fire, this matter burns with a tolerably steady flame, owing to the oily matter it contains; it spreads a smell of burnt bread, and leaves an irreducible coal, even with a great heat, which retains the same dimensions as the substance employed. Distilled it gave much oil, an acid product, which contained ammonia, besides hydro-sulphuric acid, for a paper impregnated with acetate of lead, plunged into the air of the recipient, contracted a black colour.

A solution of potash, put in ebullition with this matter, dissolved it: the liquor on being agitated presented undulations caused by a pearly matter, extremely thin, which floated as in a solution of soap; a plate of silver plunged into this liquor became brown; acids formed a white cheesy precipitate in it, and developed a smell of hydro-sulphuric acid. This matter, therefore, appeared to contain sulphur; it might be possible, however, that

this

this last was produced partly by the vegeto-animal matter retained by the parenchyme; for this, when macerated in ammonia, dissolved a small quantity of animalised matter, which might be precipitated by an acid. Concentrated sulphuric acid has little action upon this substance cold; warm, it is carbonised with the disengagement of sulphurous acid. Nitric acid heated with it dissolved it entirely, and the result was oxalic and malic acid, of a bitter yellow, and a slight yellow sediment. Iodine bruised with this matter, moistened, communicated to it a yellowish green colour. Macerated in an infusion of gall nuts, it took a brown colour, by combining with the tannin; plunged in water, and left to itself, it became covered with mouldiness. It appears to result from the properties of this *parenchymatous* substance of rice, that it is not of the same nature as the ligneous; it appears, however, less oxygenated than starch: and it is to be presumed that it shares, to a certain degree, with the latter, the known nutritive properties of rice.

Action of Alcohol upon Rice.—100 grammes of Carolina rice, macerated in water, was bruised and well divided in this liquid, and then filtered. The matter remaining upon the filter, when washed and dried, was macerated with alcohol for twenty-four hours, was afterwards heated and filtered. After several alcoholic washings the liquors were united and distilled. In order to obtain the greatest part of the alcohol, the evaporation was effected by a gentle heat; a residuum remained, which, re-dissolved by alcohol, furnished 0 g. 13 of rich oil, almost colourless, of a rancid taste and smell, having at the ordinary temperature the consistence of half-congealed olive oil, concreting by cold into a crystalline substance, which separated,

parated, and was easily dissolved in alcohol, cold, and in the alkalies *.

Distillation of Rice.—100 grains of rice, distilled, furnished a thick brown oil, but in small quantity, besides an empyreumatic liquid, which strongly reddened the blue paper dyed with turnsol, contained acetic acid, and, without doubt, a little ammonia, but which could not be rendered very sensible to the smell by bruising this acid liquid with quick lime. The gaseous product was neglected; it contained hydro-sulphuric acid, for a paper impregnated with acetate of lead being plunged into the air of the recipient, acquired a metallic appearance of sulphuret of lead. The charcoal remaining in the retort weighed twenty-two grammes; it had a metallic aspect, light, hollow, was in a single piece, harder than charcoal in general, and formed traces upon paper with difficulty: well washed with boiling water, it communicated to this liquid only imperceptible traces of alkali. Exposed to a strong heat, it could not be incinerated: treated in a crucible with potash it gave some indications of a *cyanure*. This charcoal was burnt almost entirely by nitre; the alkaline mass was dissolved in water, and an excess of hydro-sulphuric acid poured on it; ammonia was then added to the filtered liquor, which formed a deposit, weighing 0 g. 4; this was phosphate of lime; for on dissolving it in a little nitric acid, the subacetate of lead formed a precipitate, which, well washed, melted with the blow-pipe into a crystallised button of phosphate of lead.

* It is generally believed that the fat matter is only to be met with in a small number of seeds or grains, which on that account are denominated *oily*; but it appears that it exists essentially in all, and the list of plants, the seeds of which may be expressed in order to extract oil, is extremely extensive.

lead. Sub-carbonate of soda, added to the liquor from which the phosphate of lime had been separated by the ammonia, precipitated, with the help of heat, only about three centigrammes of carbonate of lime: the ashes of rice, therefore, are almost entirely formed of phosphate of lime. By appreciating, with the utmost possible accuracy, the results of the comparative analyses that I have made of Carolina and Piémont rice, I believe that we may establish approximatively their respective compositions in the following manner:

	Carolina Rice. Gramme.		Piémont Rice. Gramme.
Water	5,00		7,00
Starch	85,07		83,80
Parenchyme	4,80		4,80
Vegeto-animal matter	3,60		3,60
Incrystallisable sugar	0,29		0,05
Gummy matter, similar to starch	0,71		0,10
Oil	0,13		0,25
Phosphate of lime	0,40		0,40
Muriate of potash	0,00	Indications of	0,00
Phosphate of potash	0,00		0,00
Acetic acid	0,00		0,00
Vegetable salt, with a base of lime	0,00		0,00
Vegetable salt, with a base of potash	0,00		0,00
Sulphur	0,00		0,00
Total	100,00		100,00

List

List of Patents for Inventions, &c.

(Continued from Page 192.)

LOUIS FELIX VALLET, late of Paris, but now of Walbrook, London, Gentleman; for a new ornamental surface to metals or metallic compositions. Dated August 5, 1817.

GEORGE STRATTON, of Piccadilly, Middlesex, Ironmonger; for a method of saving fuel, by improvements in fire-places, and more effectually heating and ventilating buildings. Dated August 5, 1817.

CHARLES ATTWOOD, of Bridge-street, Blackfriars, London, Window-glass Manufacturer; for a certain improvement or improvements in the manufacture of window-glass, of the kind or description commonly wrought or fabricated into crown glass, or German sheet glass; and also in certain process or processes in the manufacture of crown glass. Dated August 5, 1817.

JOHN HAWKS, of Gateshead, Durham, Ironfounder; for a method of making iron rails, to be used in the construction of railways. Dated August 5, 1817.

LUDVIG GRANHOLM, of Foster-lane, London, Captain in the Royal Navy of Sweden; for a method or methods, process or processes, mean or means of preserving such animal and vegetable products or substances, separately or mixed together, as are fit for the food of man, and for such a length of time as to render them fit for ships and garrison stores. Dated August 5, 1817.

ANTHONY HILL, of Plymouth Iron-works, Glamorganshire, Iron-master; for improvements in the working of iron. Dated August 5, 1817.

JOHN

John Dickinson, of Nash Mill, Abbotts Langley, Hertfordshire, Esquire; for a method of manufacturing, by means of machinery, paper for copper-plate printing, also paper for writing, drawing, letter-press printing, and of a thicker sort for boards, and similar in texture and substance to card-boards or paste-boards, and certain improvements in his patent machinery for manufacturing and cutting paper. Dated August 5, 1817.

Dennis McCarthy, of Little Compton-street, St. Ann's Soho, Middlesex, Gentleman; for certain improvements on ploughs of various descriptions. Dated August 5, 1817.

John Perks, of Carey-street, St. John's Westminster, Engineer; for improvements in the apparatus for manufacturing, purifying, and storing gas. Dated August 5, 1817.

Thomas Taft, of Birmingham, Warwickshire, Sadler, whip-maker, and bridle-cutter; for an improvement in bridle-bits and leather sliding-loop, to act with reins and bits. Dated August 5, 1817.

Samuel Mersey the Younger, of Long Acre, St. Martin in the Fields, Middlesex, Laceman; for a mode or method of weaving, making, and manufacturing of livery lace and coach lace. Dated August 7, 1817.

Edmund Richard Ball, of Albany Mills, Albany, Surrey, Paper Manufacturer; for a method of manufacturing paper, of superior strength and durability, for bills or notes, or other uses, requiring strength. Dated August 9, 1817.

Edward Biggs, of Birmingham, Warwickshire, Brass-founder; for improvements in the method of making or manufacturing pans and slails of various kinds. Dated August 12, 1817.

James

James Bounsall, of Crown-street, Old-street Road, Shoreditch, Middlesex, Tailor; for improvements in the machinery used for tarring, reeling, and twisting of yarn, and forming the lissims or shands of cables, or other cordage, and manufacturing rope of every size. Dated August 12, 1817.

William Gildart and John Servant, both of Leeds, Yorkshire, House-carpenters, and Co-partners; for improvements in mangles. Dated August 12, 1817.

Jeptha Avery Wilkinson, late of New York, in the United States of America, but now residing in Covent Garden, Middlesex, Esquire; for improvements in the application of machinery for the purpose of manufacturing of weavers reeds by water or other power. Dated August 23, 1817.

George Medhurst, of Denmark-street, St. Giles in the Fields, Middlesex, Engineer; for an arrangement of implements to form certain apparatus, which he denominates the Hydraulic Balance, applicable to mechanical and hydraulic purposes. Dated August 26, 1817.

John James Alexander Mac Carthy, of Millbank-street, Westminster; for a road or way for passage across rivers, creeks, and waters, and from shore to shore thereof, without stoppage or impediment to the constant navigation thereof, and across ravins, fissures, clefts, and chasms; and for a method or methods of constructing arches or apertures for the running and flowing of water through the same, or under bridges, to be used and applied in the construction of the before-mentioned roads or way, or otherwise. Dated August 26, 1817.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLXXXV. SECOND SERIES. Oct. 1817.

Specification of the Patent granted to William Panter, *of Hampton Hill, Bath, in the County of Somerset, Gentleman; for an Invention or Improvement calculated to facilitate rotatory Motion, and lessen or remove Friction in Wheel Carriages and Machinery of different Descriptions.* Dated March 11, 1817.

With an Engraving.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said William Panter do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is particularly described and ascertained in manner following; that is to say: My improvement is applicable to that apparatus commonly known by the name of friction rollers, or more properly antifriction rollers, and which are used to diminish the friction of axles, gudgeons or pivots, which require to be supported whilst they revolve with a circular or rotatory motion; which apparatus consists of several rollers, of a cylindrical form, or other form, having a circular section, all of the same diameter, disposed at equal dis-

tances round the circumference of the cylindrical axle or pivot which is to be supported. And the said rollers are contained within the hollow cylinder, forming the box, socket, or bearing, which is to receive and sustain such pivot or axle, the rollers being of a sufficient diameter to form a contact with the external surface of the axle, and at the same time a contact with the interior surface of the box or socket. By this means the axle is supported and sustained within the cylindrical box or socket, not by the actual contact between the surfaces of the two, but by the intervention of 4, 6, 8, or other sufficient number of the rollers, to form as many points of bearing for the axle as will firmly sustain the same concentric with the box or socket in which it is to revolve; and the revolution of the axle will be greatly facilitated by such rollers, because, by turning or rolling round upon their own axes, those parts of their surfaces which form the contact with the axle accompany the axle in its motion, and in like manner those points of the surfaces of the rollers which form the contact with the internal surface of the box or socket, roll round within the same without that rubbing or sliding of the surfaces upon each other, which is called friction, because the rollers, at the same time that they roll round on their own axes, perform also a rolling round within the box in the same direction as the axle, but with a slower motion. The effect of the rollers is the same when the box turns round upon the axle, which is stationary, as when the axle revolves within the stationary box: certain means must be used by which the rollers will be retained at equal distances from each other around the axle, so as to afford an equable bearing for the same; and also the rollers must be kept exactly parallel to the axle.

And be it understood, that I do not make claim to any exclusive

exclusive privilege to make, use, and vend, friction or anti-friction rollers of the above description, but that I confine my claim to the following improvement thereon, by means of which improvement, rollers of the aforesaid description, are left freely at liberty to revolve round the axle and within the box with the two-fold motion before mentioned, at the same time that they are securely retained at equal distances from each other round the axle; and also they are retained in their required positions in the direction of the length of the axle. I make the rollers terminate at each of their ends or extremities in an obtuse conical point, which point is in the centre line, or imaginary axis of the roller. (See A, Fig. 1, Plate VIII.) I also make a frame or lantern, to contain the rollers, as shewn in Fig. 5, by B C D D; it consists of two circles or hoops, B and C, which are united together by four, or other sufficient number of pillars D. A flat or face view of one of the hoops of the lantern is shewn in Fig. 2; and a section of the lantern, with the rollers in it, is shewn in Fig. 4. The interior faces of the hoops have cavities sunk in them, which are adapted to receive the points *a a* of the rollers A: and the said cavities are of an angular shape, and rather more obtuse than the angle of the conical points of the rollers, so that the said points will touch in the bottom of the angular cavity, as shewn in Fig. 5, and retain the rollers in their due position, with respect to distance from one to the other, without confining the rollers in any other respect, because the bottom of the angular cavities or gutters, in the part where the points of the rollers are to rest, are elongated in the direction tending to the centre of the hoop, see Fig. 2, although the said cavities terminate in a line or angle at bottom, in the direction from one roller to the next, which line or angle at the bottoms of the cavities may be

 made

made more or less sharp or rounding, so that the points of the rollers are made correspondent thereunto. In one of the hoops B, these angular cavities are cut quite out to the circumference of the hoop, as shewn in Fig. 5, for the convenience of putting the rollers into their places in the lantern; and in order to retain them, a thin hoop F is put over the outside of the hoop B; but when the lantern and rollers are put into their box, they sustain themselves in their due position between the box and the axle, and the office of the lantern is only to retain them at equal distances from each other, and to keep them parallel to each other, and also to the axle.

Fig. 6 is a section of an axletree and box for wheel carriages, which is provided with rollers fitted in lanterns made or constructed according to my improvement. L is the axle arm, made cylindrical; M the shoulder, at the hurter end of the same. N the linch or collar, at the outer end of the arm, and the linch pin passing through both the linch and the axle. R the wooden nave of the wheel, having the box O O Q Q P P fixed into the centre thereof. Two sets of rollers are applied, one at each end of the arm, and they take their bearing against the inside of the box at O and P. Each set of rollers is mounted in a separate lantern, like Fig. 5, of which only the sections of the hoops B B and C C can be seen in Fig. 6; but it is to be understood that they are united by pillars as aforesaid. To prevent friction between the ends of the box and the outsides of the hoops B and C of the lantern, a washer or thin loose ring *r r* is interposed at each end of each lantern between the ends of the box T V and the surfaces of the hoop B C. And, further, the part of the box T V and of the hoop B C, which come in contact with the said loose

washers,

washers, are made convex, like a circular bead, but the washer is flat, so that there is a very diminished surface in contact, or otherwise I make a circular bead or projection upon each side of the washer, as shewn at Z, Fig. 5, which I call a bead washer, and then the ends of the box and the outsides of the hoops B and C may be made flat, as shewn at *t t*, Fig. 6. To diminish the friction of the axle endwise, or in the direction of its length, a similar bead washer may be interposed at *s*, between the outer end T of the box, and the force of the linch N, which is fastened on the end of the axle by the linch pin. The extreme end of the axle L may be made to terminate with an obtuse conical point, and a cap W fastened to the end of the nave R by screws X, the bottom of which cap bears against the said conical point of the axle, and prevents the other end T of the box from bearing against the shoulder M, at the hurter end of the axle L, or otherwise the end of the axle may be made flat, and the obtuse conical point may be formed in the bottom of the cap W, to bear against the flat end of the axle. The cap also incloses the collet and linch pin, and prevents the pin getting out by accident, so as to let the wheel off. S S is a deep hoop of iron, which surrounds the shoulder M, and is to prevent dirt and dust getting into the box. The parts O and P of the box where the two sets of rollers work being larger than the part Q, it may be advisable to make the two parts in separate pieces, and unite them together by means of the tube Q, which is first fastened firmly into the centre of the nave, and fitting a projecting neck of each of the parts O and P into the ends of Q. The ends T T of the box O and P are fitted into circular rebates, and fastened in by small screws, which admit of easy removal, to take out the lanterns and rollers at either end.

Fig.

Fig. 3 represents a lantern, to contain two sets of rollers, which are so arranged that the rollers of one set are opposite to the intervals between the rollers of the other set, which gives a greater number of points of bearing between the circumference of the axle and the box, and in like manner the lantern may be made to receive three sets of rollers. This is chiefly adapted for the axles of machinery, where the pressure is great. The diameter of the outside of the hoops of the lantern must in all cases be less than the inside of the collar of the box, and the diameter of the insides of the hoop must be greater than that of the axle, as is shewn in Fig. 4, so that the lantern cannot touch, or be obstructed in its free rotation with the rollers, but it must be supported and carried round by the conical points of the rollers alone, and be guided endways by the bead washers. The lanterns may be cast in iron, or other metal, all in one piece, or may be put together. When great strength is not required, the hoops B and C may be made as at G, Fig. 3, in which the hoop is raised up out of thick plate iron, and the cavities within side to receive the points of the rollers, produce corresponding elevations in the outside or end of the lantern; and in this case the points of bearing against the loose bead washers *t*, Fig. 6, are much diminished. The pillars D, which unite the ends or hoops B and C of the lantern together, must be made thin edgeways, so that they will never interfere with or touch the rollers, see Figs. 4 and 7; they may be fastened to the hoops by rivetting, soldering, or other means well known to workmen, or may be cast in the same piece with the hoops. H I J and K, Fig. 1, are different forms of rollers, which may in different cases be employed to facilitate rotatory motion.

I make no claim to the invention of the form or shape of

of that part of the rollers which bears between the axle and the box, but I claim the conical points of the rollers when adapted to be received in the cells of lanterns, in the manner herein before described, so that the rollers shall be unconfined in such cavities, except in respect to their distances asunder, and also the bead washers, when so applied as to retain such lanterns in their places endways in the box. The parts of this apparatus may be made of any fit metal or material, or metals or materials, but hardened steel is the best for the rollers and other parts exposed to the rolling or bearing.

In witness whereof, &c.

Specification of the Patent granted to JOHN DAYMAN, *of Tiverton, Devonshire; for a Method of covering or coating Iron, Steel, or other Metals or Mixtures of Metals, with Tin, Lead, Copper, Brass, or other Metals or Mixtures of Metals.* Dated August 3, 1816.

With a Wood Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that I the said John Dayman, in compliance with the said proviso, do hereby, and in the drawings, plans, and sections to this my specification annexed, describe and ascertain my said invention to be as follows.

Figs. 1 and 2 are my apparatus for, and method of, covering and coating pipes, tubes, and pumps. *b b* is a hollow case of some material, which either has itself no affinity with the metal it is intended to receive, or is covered with some substance which has not such affinity: iron is the material I generally use and prefer. This case is bored cylindrically true (though that is not absolutely necessary

necessary when the case is made in two parts, as hereafter mentioned); its inside is of the length and the size I intend the external part of the tube, pump, or pipe, to be when cast. This mould or outer case is divided into two equal parts, longitudinally, for the convenience of taking out the pipe, tube, or pump, when cast, though it may be made in a solid form, and the pipe pushed or drawn out; but I prefer the other, as more convenient. Each half is furnished with two flanges *c c*, running longitudinally nearly the whole length, which are to be ground perfectly true to each other, and are to be confined by screws drawing them together, or by rings driven over them, or in any other manner that will make them perfectly secure against the escape of the fluid metal which the case is intended to contain. This mould has a bottom *d d*, which may be either part of the same, and a continuation of it; in which case it will divide into two parts, like the mould, and may be furnished with flanges, but at all events must be ground, and made tight, like the others; or it may be in a solid separate piece, and made to go over and fit the bottom of the outer case, exactly so as to suffer none of the melted metal to escape, in which latter method the flanges should be taken off on the mould or case, sufficiently to let the bottom slide over it; and the lower end, *e e*, of the mould may be made a little conical, so as to fit quite tight into the bottom, which may be kept in its place by two or more small screws *f f*. In this bottom is turned a small shoulder *g g*, from one-eighth to one-fourth of an inch deep, which is destined to keep the iron, copper, or other tube, *h h*, intended to be coated, in its place; and this shoulder is at the same distance from the inner side of the case as the external coating, *i i*, of the tube of iron, copper, or other metal, is intended to be in thickness.

I next

I next make a core, *a a*, (also of iron, in the case now describing,) which I turn perfectly cylindrical, or if any thing, rather, but not perceptibly, tapering towards the bottom, for the convenience of extraction; and it has a ring or hole, *k*, in its top for the same purpose. The core is of the size of the intended internal coating, *v v*, of the pipe, and is let into a hole, *i i*, in the bottom, turned exactly to fit it, by which it is kept steady and in its place. I then take a tube *h h*, of iron, copper, or other hard metal, or mixtures of metal, but I think iron or copper the best, of the exact length required to fit the apparatus; which tube I have thoroughly and completely tinned, and made as true and straight as possible, which is best effected by a drawing machine. This tube is slipped on over the core, and its bottom goes into the shoulder *g g*, turned for it in the bottom of the case. A top *m m*, similar in principle to the bottom, with a shoulder, *n n*, to receive the tube intended to be coated, and a hole *o o*, to permit the core to pass through, is fitted to the machine: thus it is evident, that, by means of the two shoulders which receive the tube intended to be covered, and the holes in the bottom and the top which receive the core, a vacancy will be left between the case and the tube, and between the tube and the core: the top is also made to fit quite tight, and is secured as the bottom: it has several large holes, *p p p*, (which holes, if the top be made in a separate piece, should be rather larger at their bottom than at their top, in order that the metal which fills them may not, when cold, prevent the top of the apparatus from being taken off,) in it, to permit the entrance of the metal and the escape of the air. Two ears, *r r*, are affixed, one on each side, towards the top of the case, to hold it by. The whole apparatus is now plunged into a vessel containing melted lead, tin, or

 other

other metals, or mixtures of metals, the more in quantity the better, deep enough to allow it to be sunk in it, and, being forcibly held down, the melted metal enters through the holes, and fills the apparatus, giving a coating of the required thickness both to the inside and outside of the iron, copper, or other tube, to which, by the medium of the tin, it will be found so firmly united, that they will admit of being drawn together without breakage or separation. It is better to warm the apparatus before plunging it in the melted metal; and if it be suffered to remain in the melted metal a few minutes, so as to have arrived inside and out nearly at the temperature with it before it is sunk below the surface and the metal admitted to the interior, it will be the better: the apparatus should remain sunk a sufficient time for the air to escape.

The principle of the above described apparatus, by varying its form, is applicable to all purposes of coating metals inside and out, where the form of the inside coating is such as to admit of the extraction of a metal, or other permanent core, when the work is cold; but in circular work, and such as is larger in some parts of the inside than at the end, or shaped in any way so as to prevent the extraction of the metal or other core as aforesaid, a core of the same composition as is used by brass and iron founders on similar occasions, that is to say, in casting of hollow circular work, hollow angular work, and so forth, but which being so well known, I think it needless to describe, must be made instead of the metal one above described; which core, after the casting is compleat, can be taken out, as is done in cases of cast iron, brass, and so forth.

For covering or coating sheets, I make an apparatus of two flat pieces of iron $x\,x$, or other substance, (as more particularly

particularly set forth in the description of the apparatus for making tubes,) which should have flanges, *w w w w*, fitted at their edges, and be screwed, or otherwise fastened, together as to prevent the escape of the fluid metal, as in the last described apparatus, leaving a space, *y y*, between the two inner faces of the aforesaid flat pieces, equal to the thickness of the intended work when cast. Between these the piece of metal, *z*, intended to be coated, after having been prepared, if necessary, by tinning, as more particularly set forth in the description of the method of coating tubes, is to be secured, which may be done in various ways, as by grooves A A, in the inside, as at A A, in Fig. 3, or by projecting pins, or in various others ways, unnecessary to describe as being well known. The apparatus is then sunk in a vessel of melted metal, and there continued, as before described in the method of coating tubes, pumps, and so forth, the principles of both being the same, and the only variation being in the forms of the apparatus. In fact, all apparatuses may be described in general terms, to consist of a mould or moulds, of a proper substance, as before described, in which the metal intended to be coated, after being duly prepared, as before directed, is to be secured, leaving a space or spaces open, equal to the intended thickness and shape of the coating; which mould or moulds is or are to be plunged in a vessel of melted metal, of the sort intended for the coating, and there continued until the open space is filled, and all the air bubbles have escaped. It is possible in some particular cases, such as where the substance to be coated is small, and the coating intended to be a large body of metal, to effect the purpose by pouring the melted metal into the apparatus, instead of plunging the apparatus in the metal, but this mode cannot be depended on for its adhesion. I have sometimes

admitted the melted metal to the apparatus through a hole, (Fig. 1, *s*,) made somewhat conical, as in the figure in the apparatus near the bottom, communicating with a cock *t*, which is turned by a rod, with a handle *u*, and I think this the best method, especially for coatings of the softer metals, such as lead, tin, and so forth, as the air is compleatly expelled by the rising metal.

Though I have only described a single apparatus of each sort, yet it is evident any number may be made, and be so arranged in a frame, or the apparatus may be so made as to cast many at once. If an iron apparatus be used for coating iron, brass, copper, or other metal, with tin or other metal, or mixtures of metal, having such an affinity to iron as to adhere thereto, all that is necessary to be done is, after preparing the iron, copper, or other metal, by tinning, as usual, to take a painter's brush, dipped in some composition (of which so many are well known, that I think it unnecessary to describe them,) which has no affinity with the metal intended for the coating, and with this to strike over such parts of the apparatus as would occasion any injury by their adhesion to the coating when cold.

By varying the forms of the apparatus to suit the occasion, the above methods may be applied to the coating of iron, copper, and other metals and mixtures of metals, with tin, lead, and other metals or mixtures of metals, to any thickness required, and in almost any form; such as copper or iron in sheets, covered with lead to any given thickness, and thicker or not on one side than the other; iron covered with lead for railings and other works exposed to the atmospheric influence; iron or copper cisterns coated with lead, tin, or pewter; vessels for preserving water sweet at sea, being copper, with an inside coating of tin, of any given thickness. But as it is impossible

to

to imagine all the possible forms in which the wants, caprices, or whims of men may require the coating to be made, I do not think it necessary to describe particularly an apparatus for each, because any skilful workman can, from the directions, descriptions, drawings, plans, and sections herein given, construct the apparatus necessary for making any shape of coating which may be required, inasmuch as I consider the chief points of my invention to be the application of the principle of inclosing or coating a stronger, but more corruptible or injurious metal, in or with a weaker or softer, but less liable one to corrosion, or less injurious to animal life, by the means of moulds, varying to the various cases which call for them, and the application of chemical processes already well known to effecting these unions in a complete manner.

In witness whereof, &c.

Reference to the Engraving.

Fig. 1, longitudinal section of the apparatus for coating pumps, pipes, tubes, &c.

Fig. 2, horizontal section of the top of the apparatus for coating pumps, &c.

Fig. 3, horizontal section of the apparatus for coating sheets, &c.

N. B. The letters in Figs. 1 and 2 refer to the same parts in each figure.

Observations by the Patentee.

Though it is evident, from the specification, that the invention for coating metals by moulds is applicable to a great variety of useful purposes, yet, perhaps, the most valuable part of the discovery is that which relates to copper or iron pipes covered with lead, for the purposes of

of conducting water; for such (as must be evident to every one on attentive consideration, and much more so on a single inspection) is their strength and durability, that water courses once laid down with the patent pipes would last for centuries without any repair; for they will be thirty or forty times as durable as the usual lead pipes of the same bore, and therefore not liable to burst, as the latter are constantly doing on every hard frost, neither will they have the objections of iron pipes, which are constantly rusting, and which also deteriorate the water passing through them for almost all purposes, and for some render it quite useless, whereas in the patent pipes the strength of iron or copper is united to the indestructibility and sweetness of lead. They will also be rendered much cheaper than lead. Pumps also will form another very material article of manufacture; in which it is hoped the public will be supplied with an article much superior to any now in use, and upon terms still lower in proportion than the pipes, as soon as a manufactory shall be established, which has been delayed solely in consequence of the patentee, who has never been engaged in trade, rather wishing the manufacture to be taken up by a respectable house, allowing him a per centage, than embarking in it himself. Many other articles (some of which are enumerated in the specification) can be rendered of the patent manufacture, superior to any now in use, particularly the works of iron exposed to the weather. But these will suggest themselves to any one conversant with such subjects.

Note.—A Patent for coating copper sheets with tin and other metals was granted to Mr. Charles Wyatt, of Bankside, in 1790, and the public have long experienced the utility of that invention in using them for covering buildings, lining cisterns, making pipes, and other articles.

Fig.

Fig. 2.

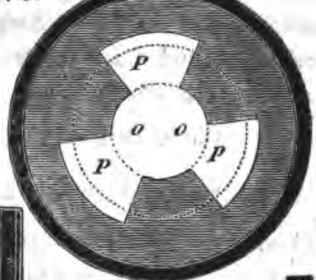


Fig. 1.

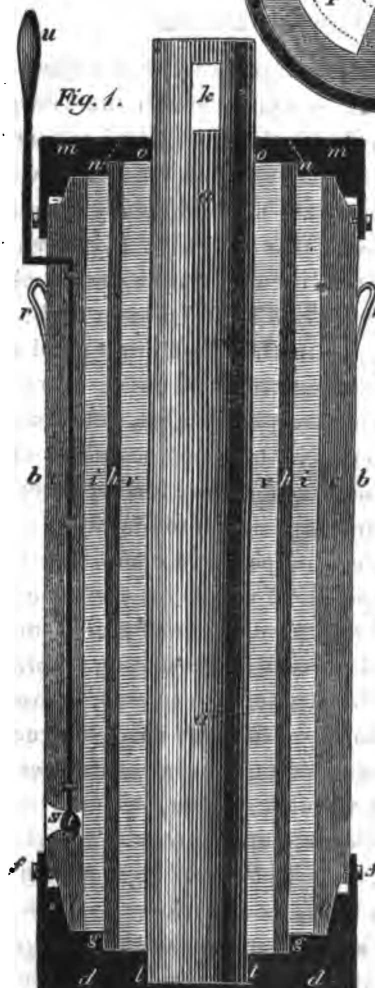


Fig. 3.

Specification

Specification of the Patent granted to JOSEPH SMITH, *of Coseley, in the Parish of Sedgley, in the County of Stafford, Iron and Coal Master; for certain Improvements in Iron and other Chains.*

Dated February 24, 1813.

With a Wood Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Joseph Smith do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows; that is to say: My invention consists of improvements in the constructing and making of a chain, which will spirally fold or lap upon itself, and by its strength, safety, durability, and other good qualities, is adapted to the purpose of drawing or raising coals, stone, and other minerals or weights, out of mines, and is also applicable to many other purposes where chain or rope is used; which improvements are further described and delineated in the drawings hereunto annexed.

No. 1 represents a piece or part of a chain, put together and completed; and No. 2 represents the same seen by a side view. For the purpose of making or manufacturing the said chain, I proceed as hereinafter described. No. 3 represents, in the manner of a section, across the axis, two steel or chill cast, or otherwise duly constructed, rollers A A, having corresponding grooves or cavities B B C C, B B C C, so cut or made in the faces thereof as that, when the said rollers are moved regularly together, with the faces thereof, in contact, and kept fair in the rim by means of wheel work, or other known and similar contrivances, the said grooves or cavities shall afford an opening or space, of which the successive forms during the

the rotation shall answer to the successive cross sections of a simple link or bar of the chain; and accordingly D E represents a bar of metal (either hot or cold, as may be needful, according to the size and the material,) in the act of passing through the said opening or space, in the direction of the small arrow near D, whereby the said bar becomes fashioned and compressed into the form of such simple links or bars, and may be, by means of cutters in the rollers, at the time of passing, or afterwards by other well-known mechanical means, divided into separate pieces at the marks G G.

And I do fashion and make such simple links or bars, and do afterwards in preference, or if required, more completely fashion the said simple links or bars, by passing and farther extending the same between the plain rollers, or the plain part of the same rollers, to act upon the side or flat faces thereof, or by striking the same between dies, properly figured, to give the precise form and dimensions to each and every thereof. And I do afterwards, by fit gages and drills, or boring or broaching tools, or by seat or punches, or other well-known mechanical methods, make holes in the said simple links or bars, as shewn unperforated in No. 4, and perforated in No. 5, in such manner, that the distances between hole and hole shall be precisely equal, and all the holes of the same size in all the said simple links or bars. Or otherwise I do make the said simple links or bars by striking or stamping the same in swages or forms, or dies, or by cutting the same with tools, of the nature of seat and punch, out of flat iron, or by various other known mechanical means; but I do greatly prefer the method by rollers, as shewn at No. 3.

And, farther, I do make a number of pins, represented at No. 6, all of the same size and length, suitable to the

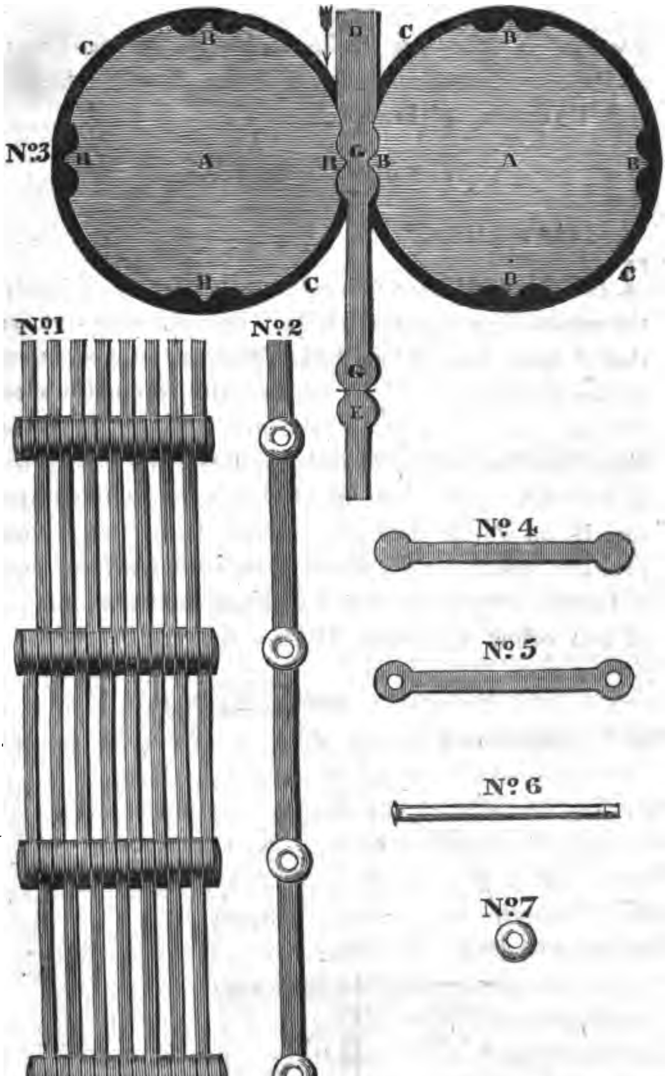
 width

width of the intended chain, and of such diameter as shall well fit the holes H H. And I do also make a number of rings, collers, or washers, as represented at No. 7, or nearly of that form, having holes therein to fit upon the ends of No. 6, and to be there stopped and kept in their respective places by rivetting, or by screw and nut, or by cotter or key, or any of the other well-known means adapted to such works.

And, farther, in constructing or putting together the chain, as represented by No. 1, I do take any required number of simple links or bars, and put the same together by an even number of links at each joint, or in the manner shewn, namely, by inserting an odd number of such links or bars alternately between an even number (having, where great precision is required, made each of the odd links so much stronger than each of the even ones, as that each set in the main or compound links of the chain shall be of the same weight, or nearly); and I do pass a pin or rivet through each correspondent set of holes, having first put a washer thereon, if fashioned with a swell, as at *a*, No. 6. And I do put on the second washer, and do rivet or screw, or key together, or make fast, the said pin or rivet, so that the same shall allow of free motion, and be secured against coming out of its place. And I do make the said chains of any required size or strength, and of any one tenacious and fit metal, or compound metal, or of more metals or metallic compounds than one, as to the several parts thereof, and of or concerning which no directions can or need be given, because the manufacturer must, and can with facility, direct his proceedings according to the nature of such materials, and the uses or purposes to which the said chain is or may be intended to be applied.

In witness whereof, &c.

No.

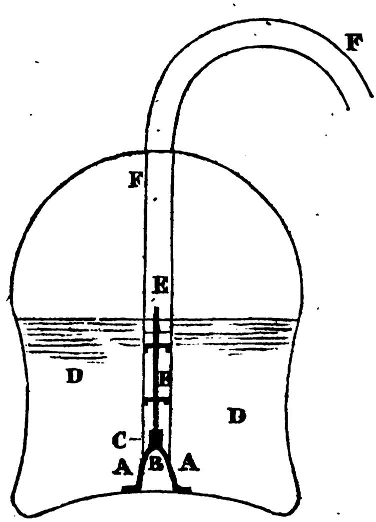

No 3
No 1
No 2
No 4
No 5
No 6
No 7
A
B
C
D
G
E

Description of a new Safety-Valve for Steam-Engine-Boilers. Communicated in a Letter to the Editors by J. PHŒNIX, *of Liverpool.*

With a Wood Engraving.

GENTLEMEN,

THE annexed plan of a safety-valve for steam boats is the result of an evening's study. It is different from any that I have seen or heard described, and appears to me to combine that simplicity and security so much wanted. All the materials used for the inside should be copper, being less disposed to corrosion. First, the tube *A* is to be fastened to the bottom of the boiler, with an aperture B, on which is to rest a weight C, of the intended pressure, meant for the steam to be worked at, say equal to twelve, twenty, or forty pounds *per* inch: all this part to rest below the water D D, a rod E E, is meant to



preserve

preserve the weight in its upright position. From this view it will be seen at once if the pressure is greater than it should be. The water in the boiler will immediately ascend, and escape through the tube F F, at once informing the passengers of the engine master's improper conduct, and relieving the pressure in the boiler; for I would have the tube to be connected with a trough upon deck, to carry the water away. Another advantage is, if the water should get too low in the boiler it will be as immediately made known by the escape of the steam.

Yours, &c.

J. PHŒNIX.

Some Researches on Flame.

By Sir HUMPHRY DAVY, *LL.D. F.R.S. V.P.R.I.*

(Concluded from Page 118.)

III. *On the Effects of the Mixture of different Gases in Explosion and Combustion.*

IN my first Paper on the fire-damp of coal mines, I have mentioned that carbonic acid gas has a greater power of destroying the explosive power of mixtures of fire-damp and air than azote, and I have ventured to suppose the cause to be its greater density and capacity for heat, in consequence of which it might exert a greater cooling agency, and prevent the temperature of the mixture from being raised to that degree necessary for combustion. I have lately made a series of experiments with the view of determining how far this idea is correct, and for the purpose of ascertaining the general phenomena of the effects of the mixture of gaseous substances upon explosion and combustion.

I took

I took given volumes of a mixture of two parts of hydrogen and one part of oxygen by measure, and diluting them with various quantities of different elastic fluids, I ascertained at what degree of dilution the power of inflammation by a strong spark from a Leyden phial was destroyed. I found that for one of the mixture inflammation was prevented by

Of Hydrogen, about	8
Oxygen	9
Nitrous oxyd	11
Carburetted hydrogen	1
Sulphuretted hydrogen	2
Olefiant gas	$\frac{1}{2}$
Muriatic acid gas	2
Silicated fluoric acid gas	$\frac{5}{6}$

Inflammation took place when the mixtures contained of

Hydrogen	6
Oxygen	7
Nitrous oxyd	10
Carburetted hydrogen	$\frac{3}{4}$
Olefiant gas	$\frac{1}{3}$
Sulphuretted hydrogen	$1\frac{1}{2}$
Muriatic acid gas	$1\frac{1}{2}$
Fluoric acid gas	$\frac{3}{4}$

I hope to be able to repeat these experiments with more precision at no distant time; the results are not sufficiently exact to lay the foundation for any calculations on the relative cooling powers of equal volumes of the gases, but they show sufficiently, if the conclusions of MM. De la Roche and Berard be correct, that other causes, besides density and capacity for heat, interfere with the phenomena. Thus nitrous oxyd, which is nearly one-third denser than oxygen, and which, according

cording to De la Roche and Berard, has a greater capacity for heat in the ratio of 1.3503 to .9765 in volume, has lower powers of preventing explosion; and hydrogen, which is fifteen times lighter than oxygen, and which in equal volumes has a smaller capacity for heat, certainly has a higher power of preventing explosion; and olefiant gas exceeds all other gaseous substances in a much higher ratio than could have been expected from its density and capacity. The olefiant gas I used was recently made, and might have contained some vapour of ether, and the nitrous oxyd was mixed with some azote; but these slight causes could not have interfered with the results to any considerable extent.

Mr. Leslie, in his elaborate and ingenious researches on heat, has observed the high powers of hydrogen of abstracting heat from solid bodies, as compared with that of common air and oxygen. I made a few experiments on the comparison of the powers of hydrogen, in this respect, with those of carburetted hydrogen, azote, oxygen, olefiant gas, nitrous oxyd, chlorine, and carbonic acid gas. The same thermometer, raised to the same temperature, 160°, was exposed to equal volumes (21 cubic inches) of olefiant gas, coal gas, carbonic acid gas, chlorine, nitrous oxyd gas, hydrogen, oxygen, azote, and air, at equal temperatures, 52° Fahrenheit.

The times required for cooling to 106° were for

	′ ″
Air	2
Hydrogen	45
Olefiant gas	1.15
Coal gas	55
Azote	1.30
Oxygen	1.47

Nitrous

*Nitrous oxyd	2.30.2.53
*Carbonic acid gas	2.45
Chlorine	3.6

It appears from these experiments, that the powers of elastic fluids to abstract or conduct away heat from solid surfaces, is in some inverse ratio to their density, and that there is something in the constitution of the light gases, which enables them to carry off heat from solid surfaces in a different manner from that in which they would abstract it in gaseous mixtures, depending probably upon the mobility of their parts †. The heating of gaseous media by the contact of fluid or solid bodies, as has been shown by Count Rumford, depends principally upon the change of place of their particles; and it is evident from the results stated in the beginning of this section, that these particles have different powers of abstracting heat analogous to the different powers of solids and fluids. Where an elastic fluid exerts a cooling influence on a solid surface, the effect must depend principally upon the rapidity with which its particles change their places: but where the cooling particles are mixed throughout a mass with other gaseous particles, their effect must principally depend upon the power they possess of rapidly abstracting heat from the contiguous particles: and this will depend probably upon two causes, the simple abstracting power by which they become quickly heated, and their capacity for heat, which is great

* These two last results were observed by Mr. Faraday, of the Royal Institution, (from whom I receive much useful assistance in most of my experiments,) when I was absent from the laboratory.

† Those particles which are lightest must be conceived most capable of changing place, and would therefore cool solid surfaces most rapidly: in the cooling of gaseous mixtures, the mobility of the particles can be of little consequence.

in

in proportion as their temperatures are less raised by this abstraction.

Whatever be the cause of the different cooling powers of the different elastic fluids in preventing inflammation, very simple experiments show that they operate uniformly with respect to the different species of combustion, and that those explosive mixtures, or inflammable bodies, which require least heat for their combustion, require larger quantities of the different gases to prevent the effect, and *vice versâ:* thus one of chlorine and one of hydrogen still inflame when mixed with eighteen times their bulk of oxygen; whereas a mixture of carburetted hydrogen and oxygen in the proper proportions for combinations, one and two, have their inflammation prevented by less than three times their volume of oxygen.

A wax taper was instantly extinguished in air mixed with one-tenth of silicated fluoric acid gas, and in air mixed with one-sixth of muriatic acid gas; but the flame of hydrogen burned readily in those mixtures; and in mixtures in which the flame of hydrogen was extinguished, the flame of sulphur burned.

There is a very simple experiment which demonstrates in an elegant manner this general principle. Into a long bottle with a narrow neck introduce a lighted taper, and let it burn till it is extinguished; carefully stop the bottle, and introduce another lighted taper, it will be extinguished before it reaches the bottom of the neck: then introduce a small tube containing zinc and diluted sulphuric acid, and at the aperture of which the hydrogen is inflamed; the hydrogen will be found to burn in whatever part of the bottle the tube is placed: after the hydrogen is extinguished, introduce lighted sulphur; this will burn for some time, and after its extinction phos-

phorus will be as luminous as in the air, and, if heated in the bottle, will produce a pale yellow flame of considerable density.

In cases when the heat required for chemical union is very small, as in the instance of hydrogen and chlorine, a mixture which prevents inflammation will not prevent combination, *i.e.* the gases will combine without any flash. This I witnessed in mixing two volumes of carburetted hydrogen with one of chlorine and hydrogen; muriatic acid was formed throughout the mixture, and heat produced, as was evident from the expansion when the spark passed, and the rapid contraction afterwards; but the heat was so quickly carried off by the quantity of carburetted hydrogen that no flash was visible.

In the case of phosphorus, which is combustible at the lowest temperature of the atmosphere, no known admixture of elastic fluid prevents the luminous appearance; but this seems to depend upon the light being limited to the solid particles of phosphoric acid formed; whereas, to produce flame, a certain mass of elastic fluid must be luminous; and there is every reason to believe, that when phosphuretted hydrogen explodes in very rare air, it is only the phosphorus which is consumed. Any other substance that produces solid matter in combustion would probably be luminous in air as rare, or in mixtures as diluted, as phosphorus, provided the heat was elevated sufficiently for its combustion. I have found that this is actually the case with respect to zinc. I threw some zinc filings into an ignited iron crucible fixed on the stand of an air pump under a receiver, and exhausted until only $\frac{1}{60}$ of the original quantity of air remained. When I judged that the red hot crucible must be full of the vapour of zinc, I admitted about $\frac{1}{60}$ more of air, when a bright flash of light took place in and above the crucible,

ble, similar to that which is produced by admitting air to the vapour of phosphorus in vacuo.

The cooling power of mixtures of elastic fluids in preventing combustion must increase with their condensation, and diminish with their rarefaction; at the same time the quantity of matter entering into combustion, in given spaces, is relatively increased and diminished. The experiments on flame in rarefied atmospherical air, show that the quantity of heat produced in combustion is very slowly diminished by rarefaction, the diminution of the cooling power of the azote being apparently in a higher ratio than the diminution of the heating powers of the burning bodies. I endeavoured to ascertain what would be the effect of condensation on flame in atmospheric air, and whether the cooling power of the azote would increase in a lower ratio, as might be expected, than the heat produced by the increase of the quantity of matter entering into combustion; but I found considerable difficulties in making the experiments with precision. I ascertained, however, that both the light and heat of the flames of the taper, of sulphur and hydrogen, were increased by acting on them by air condensed four times; but not more than they would have been by an addition of one-fifth of oxygen.

I condensed air nearly five times, and ignited iron wire to whiteness in it by the voltaic apparatus, but the combustion took place with very little more brightness than in the common atmosphere, and would not continue as in oxygen, nor did charcoal burn much more brightly in this compressed air than in common air. I intend to repeat these experiments, if possible, with higher condensing powers: they show sufficiently that, (for certain limits at least,) as rarefaction does not diminish considerably the heat of flame in atmospherical air, so neither

does condensation considerably increase it; a circumstance of great importance in the constitution of our atmosphere, which at all the heights or depths at which man can exist, still preserves the same relations to combustion.

It may be concluded from the general law, that at high temperature, gases not concerned in combustion will have less powers of preventing that operation, and likewise, that steam and vapours, which require a considerable heat for their formation, will have less effect in preventing combustion, particularly of those bodies requiring low temperatures, than gases at the common heat of the atmosphere.

I have made some experiments on the effects of steam, and their results were conformable to these views. I found that a very large quantity of steam was necessary to prevent sulphur from burning. Oxygen and hydrogen exploded by the electric spark when mixed with five times their volume of steam; and even a mixture of air and carburetted hydrogen gas, the least explosive of all mixtures, required a third of steam to prevent its explosion, whereas one-fifth of azote produced the effect. These trials were made over mercury; heat was applied to water above the mercury, and 37.5 for 100 parts was regarded as the correction for the expansion of the gases.

It is probable that with certain heated mixtures of gases, where the non-supporting or non-inflammable elastic fluids are in great quantities, combination with oxygen will take place, as in the instance mentioned, page 282, of hydrogen and chlorine, without any light, for the temperature produced will not be sufficient to render elastic media luminous; and there are no combustions, except those of the compounds of phosphorus and the metals, in which solid matters are the result of

com-

combinations with oxygen. I have shown in the paper referred to in the introduction, that the light of common flames depends almost entirely upon the deposition, ignition, and combustion of solid charcoal; but to produce this deposition from gaseous substances demands a high temperature. Phosphorus, which rises in vapour at common temperatures, and the vapour of which combines with oxygen at those temperatures, as I have mentioned before, is always luminous, for each particle of acid formed must, there is every reason to believe, be white hot; but so few of these particles exist in a given space that they scarcely raise the temperature of a solid body exposed to them, though, as in the rapid combustion of phosphorus, where immense numbers are existing in a small space, they produce a most intense heat.

In all cases the quantity of heat communicated by combustion will be in proportion to the quantity of burning matter coming in contact with the body to be heated. Thus, the blow-pipe and currents of air operate. In the atmosphere, the effect is impeded by the mixture of azote, though still it is very great: with pure oxygen compression produces an immense effect, and with currents of oxygen and hydrogen, there is every reason to believe, that solid matters are made to attain the temperature of the flame. This temperature, however, evidently presents the limit to experiments of this kind, for bodies exposed to flame can never be hotter than flame itself; whereas in the voltaic apparatus there seems to be no limit to the heat, except the volatilisation of the conductors.

The temperatures of flames are probably very different. Where, in chemical changes, there is no change of volume, as in the instance of the mutual action of chlorine and hydrogen, prussic gas (cyanogen) and oxygen, approximations

proximations to their temperatures may be gained from the expansion in explosion.

I have made some experiments of this kind by detonating the gases by the electrical spark in a curved tube containing mercury of water; and I judged of the expansion from the quantity of fluid thrown out of the tube: the resistance opposed by mercury, and its great cooling powers, rendered the results very unsatisfactory in the cases in which it was used; but with water, cyanogen, and oxygen, being employed, they were more conclusive. Cyanogen and oxygen, in the proportion of one to two, detonated in a tube of about two-fifths of an inch in diameter, displaced a quantity of water which demonstrated an expansion of fifteen times their original bulk. This would indicate a temperature of above 5000° of Fahrenheit, and the real temperature is probably much higher; for heat must be lost by communication to the tube and the water. The heat of the gaseous carbon in combustion in this gas appears more intense than that of hydrogen; for I found a filament of platinum was fused by a flame of cyanogen in the air which was not fused by a similar flame of hydrogen.

IV. *Some general Observations, and practical Inferences.*

The knowledge of the cooling power of elastic media in preventing the explosion of the fire-damp, led me to those practical researches which terminated in the discovery of the wire-gause safe-lamp; and the general investigation of the relation and extent of these powers serves to elucidate the operation of wire-gauze and other tissues or systems of apertures permeable to light and air, in intercepting flame, and confirms the views I originally gave of the phenomenon.

Flame

Flame is gaseous matter heated so highly as to be luminous, and that to a degree of temperature beyond the white heat of solid bodies, as is shown by the circumstance, that air not luminous will communicate this degree of heat *. When an attempt is made to pass flame through a very fine mesh of wire-gauze at the common temperature, the gauze cools each portion of the elastic matter that passes through it, so as to reduce its temperature below that degree at which it is luminous, and the diminution of temperature must be proportional to the smallness of the mesh and the mass of the metal. The power of a metallic or other tissue to prevent explosion, will depend upon the heat required to produce the combustion as compared with that acquired by the tissue; and the flame of the most inflammable substances, and of those that produce most heat in combustion, will pass through a metallic tissue that will interrupt the flame of less inflammable substances, or those that produce little heat in combustion. Or the tissue being the same, and impermeable to all flames at common temperatures, the flames of the most combustible substances, and of those which produce most heat, will most readily pass through it when it is heated, and each will pass through it at a different degree of temperature. In short, all the circumstances which apply to the effect of cooling mixtures upon flame, will apply to cooling perforated surfaces. Thus, the flame of phosphuretted hydrogen at common temperatures, will pass through a tissue sufficiently large not to be immediately choaked up by the phosphoric

* This is proved by the simple experiment of holding a fine wire of platinum about the one-twentieth of an inch from the exterior of the middle of the flame of a spirit lamp, and concealing the flame by an opaque body, the wire will become white hot in a space where there is no visible light.

acid

acid formed, and the phosphorus deposited*. A tissue of 100 apertures to the square inch, made of wire of $\frac{1}{60}$, will at common temperatures intercept the flame of a spirit lamp, but not that of hydrogen; and when strongly heated, it will no longer arrest the flame of the spirit lamp. A tissue which will not interrupt the flame of hydrogen when red hot, will still intercept that of olefiant gas, and a heated tissue which would communicate explosion from a mixture of olefiant gas and air, will stop an explosion from a mixture of fire-damp, or carburetted hydrogen.

The ratio of the combustibility of the different gaseous matters are likewise to a certain extent as the masses of heated matter required to inflame them †. Thus an iron wire of $\frac{1}{40}$ of an inch heated cherry red, will not inflame olefiant gas, but it will inflame hydrogen gas; and a wire of one-eighth, heated to the same degree, will inflame olefiant gas; but a wire of $\frac{1}{500}$ must be heated to whiteness to inflame hydrogen, though at a low red heat it will inflame bi-phosphuretted gas; but wire of $\frac{1}{40}$ heated even to whiteness will not inflame mixtures of fire-damp.

These circumstances will explain, why a mesh of wire so much finer is required to prevent the explosion from hydrogen and oxygen from passing, and why so coarse a texture and wire is sufficient to prevent the explosion of

* If a tissue containing above 700 apertures to the square inch be held over the flame of phosphorus or phosphuretted hydrogen, it does not transmit the flame till it is sufficiently heated to enable the phosphorus to pass through it in vapour. Phosphuretted hydrogen is decomposed in flame, and acts exactly like phosphorus.

† It appeared to me in these experiments, that the worst conducting and best radiating substances required to be heated higher for equal masses to produce the same effect upon the gases; thus, red hot charcoal had evidently less power of inflammation than red hot iron.

the

the fire-damp, fortunately the least combustible of the known inflammable gases.

The general doctrine of the operation of wire-gauze cannot be better elucidated than in its effects upon the flame of sulphur. When wire-gauze of 600 or 700 apertures to the square inch is held over the flame, fumes of condensed sulphur immediately come through it, and the flame is intercepted; the fumes continue for some instants, but as the heat increases they diminish, and at the moment they disappear, which is long before the gauze becomes red hot, the flame passes; the temperature at which sulphur burns being that at which it is gaseous.

Another very simple illustration of the truth of this view is offered in the effect of the cooling agency of metallic surfaces upon very small flames. Let the smallest possible flame be made by a single thread of cotton immersed in oil, and burning immediately upon the surface of the oil: it will be found to be about $\frac{1}{30}$ of an inch in diameter. Let a fine iron wire of $\frac{1}{180}$ be made into a circle of $\frac{1}{10}$ of an inch in diameter, and brought over the flame. Though at such a distance, it will instantly extinguish the flame, if it be *cold:* but if it be held above the flame, so as to be slightly heated, the flame may be passed through it without being extinguished. That the effect depends entirely upon the power of the metal to abstract the heat of flame, is shown by bringing a glass capillary ring of the same diameter and size over the flame; this being a much worse conductor of heat, will not extinguish it even when *cold.* If its size, however, be made greater, and its circumference smaller, it will act like the metallic wire, and require to be heated to prevent it from extinguishing the flame *.

* Let a small globe of metal, of one-twentieth an inch in diameter, made by fusing the end of a wire, be brought near a flame

 of

Suppose a flame divided by the wire-gauze into smaller flames, each flame must be extinguished in passing its aperture till that aperture has attained a temperature sufficient to produce the permanent combustion of the explosive mixture.

A flame of sulphur may be made much smaller than that of hydrogen, that of hydrogen smaller than that of a wick fed with oil, and that of a wick fed with oil smaller than that of carburetted hydrogen; and a ring of cool wire, which instantly extinguishes the flame of carburetted hydrogen, only slightly diminishes the size of a flame of sulphur of the same dimensions.

Where rapid currents of explosive mixtures are made to act upon wire-gauze, it is of course much more rapidly heated; and therefore the same mesh which arrests the flames of explosive mixtures at rest, will suffer them to pass when in rapid motion; but by *increasing* the cooling surface by diminishing the size, or increasing the depth of the aperture, all *flames*, however rapid their motion, may be arrested. Precisely the same law applies to explosions acting in close vessels: very minute apertures when they are only few in number will permit explosions to pass, which are arrested by much larger apertures when they fill a whole surface. A small aperture was drilled at the bottom of a wire-gauze lamp in the cylindrical ring which confines the wire-gauze; this, though less than $\frac{1}{18}$ of an inch in diameter, passed the flame and fired the external atmosphere, in consequence of the whole force of the explosion of the thin stratum of the mixture

of one-thirtieth in diameter, it will extinguish it when cold at the distance of its own diameter; let it be heated, and the distance will diminish at which it produces the extinction; and at a white heat it does not extinguish it by actual contract, though at a dull red heat it immediately produces the effect.

included

included within the cylinder driving the flame through the aperture; though, had the whole ring been composed of such apertures separated by wires, it would have been perfectly safe.

Nothing can demonstrate more decidedly than these simple facts and observations, that the interruption of flame by solid tissues permeable to light and air, depends upon no recondite or mysterious cause, but to their cooling powers, simply considered as such.

When a light included in a cage of wire-gauze is introduced into an explosive atmosphere of fire-damp at rest, the maximum of heat is soon obtained, the radiating power of the wire, and the cooling effect of the atmosphere, more efficient from the mixture of inflammable air, prevents it from ever arriving at a temperature equal to that of dull redness. In rapid currents of explosive mixtures of fire-damp, which heat common gauze to a higher temperature, twilled gauze, in which the radiating surface is considerably greater, and the circulation of air less, preserves an equal temperature. Indeed the heat communicated to the wire by combustion of the fire-damp in wire-gauze lamps, is completely in the power of the manufacturer, for by diminishing the apertures, and increasing the mass of metal, or the radiating surface, it may be diminished to any extent.

I have lately had lamps made of thick twilled gauze of wires of $\frac{1}{40}$, sixteen to the warp, and thirty to the weft, which being rivetted to the screw, cannot be displaced; from its flexibility it cannot be broken, and from its strength cannot be crushed, except by a very strong blow.

Even in the common lamps the flexibility of the material has been found of great importance, and I could

quote one instance of a dreadful accident having been prevented, which must have happened had any other material than wire-gauze been employed in the construction of the lamp: and how little difficultly has occurred in the practical application of the invention, is shown by the circumstance, that it has been now for ten modths in the hands of hundreds of common miners in the most dangerous mines in Britain, during which time not a single accident has occurred where it has been employed, whilst in other mines, much less dangerous, where it has not yet been adopted, some lives have been lost, and many persons burned *.

The facts stated in Section II. explain why so much more heat is obtained from fuel when it is burnt quickly; and they show that in all cases the temperature of the acting bodies should be kept as high as possible, not only because the general increment of heat is greater, but likewise, because those combinations are prevented which at lower temperatures take place without any considerable production of heat: thus, in the Argand lamp, the Liverpool lamp, and in the best fire-places, the increase of effect does not depend merely upon the rapid current of air, but likewise upon the heat preserved by the arrangements of the materials of the chimney, and communicated to the matters entering into inflammation.

These facts likewise explain the methods by which temperature may be increased, and the limit to certain methods.

* These lamps are applicable to all purposes in which explosions or inflammations are to be guarded against, whether from fire damp or carburetted hydrogen, coal gas, vapours of spirits, or of ether. And by the introduction of glass cylinders within the wire-gauze cylinder *above* the flame, the wick may be made very large, and it burns on the principle of the Liverpool lamp.

methods. Currents of flame, as it was stated in the last section, can never raise the heat of bodies exposed to them, higher than a certain degree, their own temperature; but by compression, there can be no doubt, the heat of flames from pure supporters and combustible matter may be greatly increased, probably in the ratio of their compression. In the blow-pipe of oxygen and hydrogen the maximum of temperature is close to the aperture from which the gases are disengaged, *i. e.* where their density is greatest. Probably a degree of temperature, far beyond any that has been yet attained, may be produced by throwing the flame from compressed oxygen and hydrogen into the voltaic arc, and thus combining the two most powerful agents for increasing temperature.

The circumstances mentioned in this Paper, combined with those noticed in the Paper on Flame, printed in Mr. Brande's Journal of Science and the Arts, explain the nature of the light of flames and their form. When in flames pure gaseous matter is burnt, the light is extremely feeble: the density of a common flame is proportional to the quantity of solid charcoal first deposited and afterwards burnt. The form of the flame is conical, because the greatest heat is in the centre of the explosive mixture. In looking steadfastly at flame, the part where the combustible matter is volatilised is seen, and it appears dark, contrasted with the part in which it begins to burn, that is where it is so mixed with air as to become explosive. The heat diminishes towards the top of the flame, because in this part the quantity of oxygen is least. When the wick increases to a considerable size from collecting charcoal, it cools the flame by radiation, and prevents a proper quantity of air from mixing with its

its central part: in consequence, the charcoal thrown off from the top of the flame is only red hot, and the greater part of it escapes unconsumed.

The intensity of the light of flames in the atmosphere is increased by condensation, and diminished by rarefaction, apparently in a higher ratio than their heat, more particles capable of emitting light exists in the denser atmospheres, and yet most of these particles in becoming capable of emitting light, absorb heat, which could not be the case in the condensation of a pure supporting medium.

The facts stated in Section I. show that the luminous appearances of shooting stars and meteors cannot be owing to any inflammation of *elastic* fluids, but must depend upon the ignition of solid bodies. Dr. Halley calculated the height of a meteor at ninety miles, and the great American meteor, which threw down showers of stones, was estimated at seventeen miles high. The velocity of motion of these bodies must in all cases be immensely great, and the heat produced by the compression of the most rarefied air from the velocity of motion must be probably sufficient to ignite the mass; and all the phenomena may be explained, if *falling stars* be supposed to be small solid bodies moving round the earth in very eccentric orbits, which become ignited only when they pass with immense velocity through the upper regions of the atmosphere, and if the *meteoric bodies* which throw down stones with explosions be supposed to be similar bodies which contain either combustible or elastic matter.

Cobham Hall, Kent,
Jan. 8, 1817.

On

On the mechanical Structure of Iron developed by Solution, and on the Combinations of Silex in Cast Iron.

By J. F. Daniell, *Esq. F. R. S. and M. R. I.*

(Concluded from Page 242.)

THE next object of inquiry is the nature of the gray substance unacted upon by the acids.

Nitric acid, and nitro-muriatic acids, did not act upon it at a boiling heat.

When examined with a magnifier, it did not seem to be perfectly homogeneous in its composition, but presented the appearance of bright metallic particles, powdered and mixed with a grayish white dust. It deflagrated with nitre and oxymuriate of potash at a very high heat.

Some of it was fused with pure soda in a silver crucible. When it entered into igneous fusion, a gas was given off, which burnt with flame, and slight explosion. When cold it was of a greenish colour. It was dissolved out with distilled water, and much of the powder was found to have been unacted upon. It was digested in muriatic acid, and had now assumed a brighter aspect, and was of a perfectly uniform texture, exactly resembling micaceous iron ore in small thin scales. The muriatic acid had taken up some oxyd of iron.

The sodaic solution was saturated with muriatic acid. It effervesced strongly. It was evaporated, and when reduced to about one-half it gelatinised. When perfectly dry the muriate of soda was dissolved, and nothing but pure silex remained.

Guided by these hints, and by many other preparatory experiments, which it would be tedious to enumerate, I obtained the following more determinate results.

35 grains of the gray powder, which had been thoroughly separated from all oxyd of iron, by digestion in muriatic acid, were exposed to a low red heat, in a silver crucible, with 200 grs. of pure soda. When a puff of gas took place, the crucible was instantly removed from the fire. The contents were dissolved out with distilled water. The solution was filtered, and the residue well washed and dried. It weighed 10.9 grs. It was digested in muriatic acid, again washed and dried. It then weighed 10.0. It now exactly resembled the micaceous iron.

The muriatic solution let fall a small quantity of red oxyd of iron upon the addition of ammonia.

The sodaic solution was saturated with muriatic acid. It barely effervesced. It was evaporated to dryness, and towards the end of the operation it gelatinised. It was diligently stirred till dry. The muriate of soda was dissolved, and the remaining white insoluble substance heated to redness. It then weighed 23.8 grs. and possessed all the properties of silex.

Here then we arrive at another step of our inquiry; and we find that the 95.6 grs. of the gray substance is composed of

65.0 silex,

30.6 metallic substance, like micaceous iron.

for 35.0 : 23.8 : : 95.6 : 65.

The small quantity of oxyd of iron obtained, and the slight effervescence of the soda, was owing, as we shall afterwards find, to the decomposition having been carried a little too far.

50 grs. of the micaceous substance, which had all been subjected to the action of red hot soda, were mixed with 500 grs. of pure soda in a silver crucible. It was exposed for two hours to a heat just short of the melting of the silver. A large quantity of inflammable gas burned off.

off. When this had ceased, the crucible was removed from the fire, and allowed to cool. It was digested in distilled water, and the solution passed through the filter. What remained was well washed and dried, and weighed 31.8.

This was digested in muriatic acid, and afterwards weighed 23.8.

The muriatic solution was precipitated with ammonia, and the red oxyd of iron weighed exactly 8.0 grs. corresponding to the deficiency of weight. The remainder was found to be the micaceous substance, totally unaltered in its characters.

The sodaic solution was neutralised with muriatic acid, and gave off carbonic acid in abundance.

It was then evaporated to dryness, and during the process it gelatinised. It was digested in distilled water, and the remainder, which was perfectly white, heated to redness. It weighed 5.8.

Again, to collect the results as we proceed, 50 grs. were employed, of which 23.8 were unacted upon. The 26.2 furnish us with

8.0	oxyd of iron.
5.8	silex.
12.4	loss.
26.2	

To ascertain the nature of this loss, which, from previous experiments, is probably carbon, the following experiments were undertaken.

10 grs. were accurately mixed and triturated in a mortar, with 400 grs. of oxymuriate of potash. This mixture was put into an apparatus composed of part of a gun-barrel, closed at one end, and furnished with a flexible

metallic tube at the other, which dipped into the first of a series of Woulfe's bottles charged with lime water. A strong red heat was applied to the barrel, and the carbonic acid produced precipitated the lime in the bottles, the last of which remained perfectly clear and undisturbed. The precipitate was carefully collected and dried; it weighed 38.8 grs.

Now, 100 parts of carbonate of lime contain 44 carbonic acid, therefore 100.0 : 44.0 : : 38.8 : 17, and 100 carbonic acid contains 28.6 of carbon, and 100.0 : 28.6 : : 17.0 : 4.8.

But in the barrel 0.8 grs. were found to have been unacted upon. Therefore, 9.2 of the carburet contains 4.8 of carbon.

If we now apply this to the preceding experiment, we shall find that there is an excess in the products;

For 9.2 : 4.8 : : 26.2 : 13.6,

which gives the result—

8.0	oxyd of iron.
5.8	silex.
13.6	carbon.
27.4	
26.2	
1.2	excess.

Of this excess in the products we shall consider the cause hereafter.

I shall proceed at present to relate another experiment which remarkably confirms the results of the others, though by a totally different method.

28.5 grs. of the carburet were mixed with 500 grs. of pure soda, and placed in an iron tube, similarly prepared to

to that in the last experiment. It was gradually heated to redness, and when gas began to be given off, the flexible pipe was adapted to it, and passed under the surface of lime water, in a Woulfe's bottle, communicating with the pneumatic trough. The heat was raised to a bright red, and continued for two hours. The gaseous products were collected in a bell glass, having passed through the lime water without producing any milkiness. The gas collected amounted to 56 cubic inches.

When the gas had ceased to come over, the apparatus was allowed to cool, and the contents of the barrel washed out. The solution was passed through the filter, and the substance remaining upon it, washed and dried, weighed 13.5. It was digested in muriatic acid, again washed and dried, and weighed 6.5. It was the carburet unaltered. The loss of weight was owing to oxyd of iron, as shewn by the examination of the muriatic solution.

The sodaic solution was put into a gas bottle, fitted with an acid holder, and communicating with a mercurial gasometer. Muriatic acid was allowed to mix gradually with it, and 39 cubic inches of carbonic acid were thus collected. The solution was then evaporated to dryness. The silex being washed and heated to redness, weighed 4.9.

The gas which had been collected was next examined. It burned with a yellow flame. When sulphur was sublimed in it carbon was deposited, and when exploded with chlorine, fuliginous matter lined the tube.

A cubic inch of the gas was mixed with two cubic inches of oxygen, in an exhausted tube, and fired, with an electrical spark, lime water was admitted and agitated. Carbonate of lime was formed, and the absorption was $\frac{25}{10}$. The residue consisted of oxygen, and va-

ried in different experiments, from $\frac{3}{10}$ to $\frac{6}{10}$ of a cubic inch. When the oxygen was decreased in this proportion, the absorption was within $\frac{1}{10}$ of being total; and this small residue was probably owing to a little atmospheric air.

Now, as pure carburetted hydrogen condenses just double its bulk of oxygen, it follows that a little hydrogen was mixed with this gas, and an average of the experiments would make the mixture 50 cubic inches of carburetted hydrogen, and six inches of hydrogen.

Of 28.5 grs. of the carburet employed, 6.5 were recovered unaltered. 22 grs. were therefore decomposed. 39 cubic inches of carbonic acid weigh 18.3, and contain 5.0 of carbon, and 50 cubic inches of carburetted hydrogen weigh 8.5, and contain 6.2 of carbon *.

The analysis therefore stands thus:

7.0	oxyd of iron.
4.9	silex.
11.2	carbon.
23.1	
22.	
1.1	excess.

Considering the complication of these experiments, and the difference in the method of operating, their agreement is nearer than could well have been expected.

The excess in the products is no doubt owing to the oxygenation of one or more of them in the process. The iron, as it is obtained in the results, is in the state of red

* These calculations are made from Davy's Elements. The barometer, at the time of the experiment, was 29.74, and the thermometer 55°. I have not made the calculation for the mean pressure and temperature, the difference being so small.

oxyd.

oxyd. If we suppose that it exists in the double carburet in the metalline state, there would be a deficiency instead of an excess. For 7.0 red oxyd of iron is only equal to 4.8 of the metal, and thus the result would be,

4.8	iron.
4.9	silex.
11.2	carbon.
20.9	
1.1	deficiency.
22.0	

I am inclined, from all circumstances, to believe, that the triple carburet, as it is first obtained, consists of iron and silicum, in the metalline state, united to carbon. When brought into contact with oxygen gas, the metals become converted to protoxyds, giving out heat, without separating from the carbon; and when decomposed at a red heat by soda, they become oxygenated to the utmost, at the expense of the water which is still found in the alkali at that temperature.

Red oxd. iron 7.0 =	6.2	black oxd.
	4.9	silex.
	11.2	carbon.
	22.3	
	22.	
	.3	surplus,

arising from the oxygenation of the silex?

This idea is further confirmed by the following experiment. 3 grs. of the double carburet, perfectly pure, were placed in a glass tube, with one gr. of potassium. The air was exhausted, and the tube heated to redness. It was then allowed to become perfectly cool. When the air was admitted, the ingredients became instantly red hot.

hot. Upon washing the products, the carburet was obtained unaltered.

The following comparative experiments mark a distinctive difference between this body and some others, and confirm the general results.

Plumbago and potassium, heated in the same way in vacuo, did not heat upon the admission of the air.

Lamp black and potassium did not heat. Plumbago, in an ignited stream of mixed oxygen and hydrogen, burnt away, and left a red ash.

The double carburet, burnt in the same way, left a white ash.

Carbon collected from the solution of steel in an acid, possessed no metallic lustre, and ignited at the flame of a common candle, burning like tinder. The carburet was not affected by any heat short of that of the blow-pipe.

I wish, in conclusion, to draw attention to certain analogies which subsist between these experiments, and others performed by more able hands, for the purpose of establishing the existence and properties of silicum.

Sir H. Davy, in his Elements of Chemical Philosophy, says, "When potassium is brought in contact with silica, ignited to whiteness, a compound is formed, consisting of silica and potassa, and black particles, not unlike plumbago, are found diffused through the compound.

"From some experiments I made, I am inclined to believe that these particles are conductors of electricity; they have little action upon water, unless it contain an acid, when they slowly dissolve with effervescence; they burn when strongly heated, and become converted into a white substance, having the characters of silica."

When it is considered that most of the potassium, which is prepared for experiment, however well it may be cleaned, contains no inconsiderable portion of carbon,

is

is it improbable that these particles, not unlike plumbago, may have been a carburet of silicum? Its little attraction for the oxygen of water agrees very well with the phenomena which we have just been considering.

Professor Berzelius and M. Fred. Stromeyer have succeeded in producing a compound, which they consider as a combination of iron, silicum, and carbon. Their method was to select very pure iron, silex, and charcoal. These they made into a paste, with gum or linseed oil, and heated them very intensely, in a covered crucible. Their reasons for supposing that silicum, in the metallic state, existed in the product, were these: That the iron and silex extracted from the alloy, when taken together, very sensibly exeeeded the weight of the alloy examined: that the alloy gave a much greater quantity of hydrogen, with muriatic acid, than the iron alone which it contained would have given: and, that there is no known combination of a metal with an earth, which requires the successive operation of the most powerful agents to decompose it as this alloy did. The colour of this compound was that of common steel.

The quantities of the component parts, however, of this alloy differed very materially from those of the purified carburet obtained from cast iron. They varied from 85.3 of iron, 9.2 of silicum, and 5.3 of carbon, to 96.1 of iron, 2.2 of silicum, and 1.6 of carbon. They were likewise highly magnetic, (owing no doubt to the great quantity of iron,) which the triple carburet is not *.

I have stated, that the quantity of the silex and triple carburet yielded by the iron which I employed, rather decreased in the interior of the mass. Towards the latter

* See Phil. Mag. No. 173, translated from the Swedish original; and Ann. Chim. tom. 81, from Gottingen Trans.

end

end of my experiments, I estimated the relative proportions. The iron was dissolved in muriatic acid, and the insoluble residue, after it had absorbed its dose of oxygen, was digested in muriatic acid. These solutions were precipitated by ammonia, evaporated to dryness, and exposed to a strong heat. The residue was boiled to dryness, with a little nitric acid, and again heated. The quantity of red oxyd of iron thus obtained, amounted to 738 grs. which are equal to about 513 grs. of metallic iron.

The quantity of the gray mixture of silex and double carburet amounted to 93 grs.

The mean results of all the experiments stand thus:

	1000 grs. of the gray cast iron		
yield	846.6 iron		
	153.4 consisting of silex		104.3
	1000.0	double carburet	49.1
			153.4

100 grs. of the double carburet of iron and silex, upon an average of five experiments, gave the following results:

Red oxyd of iron	31.2=	28.0	black oxyd.
Silex	22.3=	20.6	oxyd of silicum ?
Carbon	51.4=	51.4	carbon.
	104.9=	100.0	

Although the existence of silicum in the metallic state, alloyed with iron, is not actually proved by the foregoing experiments, yet the probability of such a compound I conceive is greatly increased by them. Indeed, reasoning from analogy alone, it is hardly possible that ten *per cent.*

cent. of silex, could exist in union with the metals in any other manner. When we look to the result of intensely heating the oxyds of the alkaline metals, in contact with iron, it would be surprising if the earthy oxyds could resist decomposition, in the long-continued and intense heat of the iron furnaces.

The process of puddling is almost evidently dependent upon the same supposition. The oxydation of the metals of the earths is more likely to produce the heaving and internal motion of the iron in that process than the mere burning away of carbon; and the sudden visible spontaneous increase of temperature can hardly be explained upon any other principle. I have examined the slag or black oxyd, which is pressed out from the iron by rolling, after it has undergone this operation. I extracted the greater part of the black oxyd of iron which is combined with it by muriatic acid; the matter which was left was a complete glass, composed of above 80 *per cent.* of silex with lime. There was no trace of carbon. Such a result is exactly consonant with this idea of the process.

Much remains still to be done to complete our knowledge of the nature of cast iron. Notwithstanding the numerous experiments which have been made upon it, we remain in comparative ignorance of its composition. Guided by the new lights which the science of chemistry has lately acquired, an accurate revision of the subject could not fail to repay those who have an opportunity of tracing the changes of the metal in the various stages of its manufacture.

On feeding Cattle.

By JOHN CHRISTIAN CURWEN, *Esq. V. P. M. P. of Workington Hall, Cumberland.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Gold Medal was voted to Mr. CURWEN *for this Communication.*

UNDER the fostering influence of the Society of Arts, &c. great has been the advantage reaped by the Empire in every useful branch of knowledge. The hope of their honours has, and I trust will, to the latest period, form a powerful stimulus to exertion. I speak feelingly:—Many of my experiments would otherwise have never been undertaken. My sense of gratitude for their favours is not, I trust, the only effect produced. The sanction of their patronage on the system of soiling has had an extensive influence in spreading the practice through every part of this country. The favourable light in which it is held encouraged me to attempt extending the practice still further, and suggested the trying to rear cattle by the same means.

The objects to be gained were a more early maturity, a diminished risk in rearing, a saving in cost in feeding, and the creation of an additional quantity of manure. The farmer and public were likely to be benefited, and the experiment was successful.

The result which I have now the honour of submitting to the Society, will, I hope, prove satisfactory to them, and conclusive as to the success which has attended the experiment in every point.

Seventeen

Seventeen calves were reared in the course of the last year: eleven short-horned, or Durham breed; six Ayrshire. Of those turned into the yard, which is done when they are two months old, not one has been lost, nor have they been subject to any complaint. Attention was particularly paid to them at the period of changing their food from turnips to clover. The intention of the experiment being to bottom the practice on a system which might afford a prospect of profit to the farmer, all costly food was rejected. The first month the calves had but one gallon of new milk *per* day; for three months afterwards three gallons *. A winter dairy being what is aimed at, most of the calves are dropped from November till April. Turnips and hay were given with the milk, but neither cake or meal. From June till October the food was clover; afterwards, till the end of May, turnips; till Christmas they had some little hay, *being well taken to the turnip*, straw was substituted.

In size they were little inferior to those of double their age. So good was their condition, that one of the Ayrshire heifers, of eighteen months, was butchered. The live weight was fifty-five stone, of fourteen pounds to the stone. The carcase was thirty-one stone nine pounds, and the loose fat two stone nine pounds. The animal was weighed without fasting, which was equal to a tenth of its weight. The carcase was esteemed particularly beautiful, and the meat highly approved of by the Members who saw it, (for it was killed at the meeting of the Workington Society.) Not one of the numerous visitors who was not agreeably disappointed as to the result. The short-horned, or Durham breed, were in much greater

* The 25 calves of this year had 7,072 gallons two quarts, of new milk.

condition, and would have killed six-and-forty stone at least. The gain on turnips was fully three pounds a day on each of the Durham heifers. I conceive there would be no difficulty in bringing up the heifers to sixty stone of carcase at two years old. They consumed on an average six stone of turnips a day; of hay they had about half a stone: when straw was given no account was taken. Besides the food I have just mentioned, they had a feed of steamed chaff; the benefit of which was solely from its warmth, in preventing the green food disagreeing with them, as it would otherwise have been cast into the dung-hill.

The produce of two acres, divided between turnip and clover, would be abundantly sufficient to support a beast to two years old. The comparison between animal and vegetable food would be thus:—A fallowed acre of wheat may be supposed to produce thirty Winchesters of sixty pounds weight, or 1800 pounds; sixty stone of carcass would be 840, taking the loose fat at five stone; seventy pounds total at 980 pounds; so that the animal food, on this system, would be equal to one half of the vegetable, where fallow is introduced; under any other system, nearly equal to a third.

The manure created was very considerable. As this depends on the quantity of straw, it is difficult to say to what extent it might be carried. In soiling in the house, the calculation is a ton a month for each beast, and not much less might be made by this mode, though not of equal quality. In the present year I have reared five-and-twenty calves with equal success. The progress is always greater on turnip than clover. The heifers of twenty months are now taken into the house, and will, as occasion offers, be given the bull. In size and figure they are of great promise. The success of the experiment has

has both pleased and surprised all who have seen them: nor has the example been without its effect; some of the farmers in the neighboured have already adopted the practice. Gratified shall I be if this meets with the approbation of the Society, and shall be happy to render any further information that may be required, trusting this new system of soiling may be as favourably received as what I formerly submitted to them. I had then no other claim to meet than that of adopting a practice prevalent in the Netherlands. At present I am a candidate for originating a system not previously known.

I beg leave to subjoin an account of the mode of burning surface soil and clay, by the use of hot lime. This practice, which bids fair to be attended with important consequences, has long been in use in Ireland. On the bogs I observed it (in a recent tour through that country) with great satisfaction, and lost no time in adopting it. The first attempt was the burning it in kilns with roots and blocks of wood. The cost was considerable, which led to the attempting it with hot lime; seventy Winchesters of lime, directly from the kiln, spread on a leyer of sods, eight yards in length and five in breadth, between some layers of sods, of a foot each, will in twenty-four hours ignite it. Fresh sods must then be applied, and when a quantity of ashes are once procured, a proportion of clay may be burnt with it; by this mode the fire is never so hot as to vitrify the ashes. The fructifying quality depending, probably, on the union with the atmosphere, the ashes will benefit in proportion to their power of absorption. I have Swedes, with sixty single-horse carts of ashes, little inferior to those that had one hundred of dung; common turnips, from forty carts, that are forty tons *per* acre, and this on strong clay, not deemed fit for turnip culture. I have twenty-one acres, with

with only twenty cart load, that are highly promising; these are on new ground. Sixty acres of wheat, from forty carts of ashes and sixty Winchesters of lime; this was but a light crop. The soil being a clay, and the elevation great, I am disposed to attribute the lightness of the crop to its being sown too late in the season. The clover is admirable, and such as was never seen on this farm. By this power of creating manure, a much larger proportion of dung may be given to clay ground; the benefit of which, I am disposed to believe, will most amply compensate. I hope at some future period to be able to bring this subject before the Society. My potatoes have been housed some days, and wheat sown. Another week of good weather will see sixty acres of turnips stacked, and wheat sown. By this practice, and more early sowing, many of the objections to growing turnips on dry soils are obviated.

In the preceding account I have committed a blunder on the comparative produce of vegetable and animal food. An acre of fallowed wheat produces 128 stone eight pounds, of thirty Winchesters of sixty pounds. I fear I have stated this as only ninety; the produce in animal food sixty-five, being one half. I do not know how I got wrong on this point: I am glad, however, to have detected it. I consider this as the most important object I have accomplished in farming, and one likely to be very speedily adopted.

Letter from G. Scott Elliott, *Esq. to the Secretary.*

In reply to the letter which you did me the honour to address to me, of the 30th ult. relative to my friend Mr. Curwen's

Curwen's mode of rearing stock, I have only to say, that I have now been in the habit of examining their general state and condition annually for years past, and have universally found that no cattle in the country have ever been in any thing like their order, either in point of fatness or healthfulness. It was, however, only last year that we had an opportunity of witnessing the effect of his system of winter feeding on steamed food, as practised upon *young cattle*, and though their *progress* and *condition* certainly *surpassed any thing I had ever before observed at their early age*, yet I do not know how far it might be judicious to recommend the use of it generally among practical farmers, until a more minute scrutiny had been made respecting the expense of labour, fuel, and food. Should it be any satisfaction to the Society to obtain a minute detail of those particulars, I shall consider it no trouble to provide them with the most accurate information I can collect, by a personal examination into every circumstance on the spot. I think, however, that there is no one who saw Mr. Curwen's young cattle last year, (which had been entirely brought up in open sheds, never depastured,) but must have received a most favourable impression of the plan, or would withhold from him his due meed of praise.

Woodslee, Longtown, April 8, 1816.

Letter from L. Ellis, *Esq. to the Secretary.*

I have been much from home lately, otherwise your letter of the 30th ult. should not have remained so long unanswered; nor am I at present able to give you a full answer to all the particulars your very proper enquiries extend to.

I was

I was only at Workington during the Agricultural Meeting, when my attention was so much divided, that I had not an opportunity of entering so minutely into the investigation of the method of rearing young cattle, in point of economy, so that it is at this moment not in my power to say to what probable extent the plan may be extended, nor whether it will, with the expenses attending it, be a profitable mode for the farmer to adopt.

Mr. Curwen's young stock (those of a year old and upwards,) were certainly superior in size and condition to any that I had before seen fed upon steamed chaff, straw, and turnips, excepting particular animals reared regardless of the cost of the food: but Mr. Curwen grows so many turnips, and maintains so very few sheep in proportion to what has hitherto been the practice of the most successful agriculturist, that I yet doubt that his whole system does not return that remuneration that is obtained where fewer cattle are kept. In coming to this opinion, I have kept in view that nearly the whole of the land occupied by Mr. Curwen is not adapted for sheep to eat turnips on the spot they are grown upon; but this does not preclude their being led into a by-field, and eat them with great advantage to the land and to the sheep.

I propose being at Workington early in August next, at which time I will particularly examine the detail of the process of feeding from the pail to the time they are sold to the butcher, when I will again do myself the pleasure of addressing you.

Longtown, April 13, 1816.

Description

Description of an Invention called "The Expeditious Navigator." By Mr. THOMAS PERING, *of Dorset-street, Salisbury-square.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Gold Isis Medal was voted to Mr. PERING *for this Communication.*

I HAVE the honour to lay before the Society of Arts and Sciences an invention under the title of "The Expeditious Navigator," an attempt to simplify and facilitate the comprehension of the science of navigation. The short explanation prefixed to it has been considered amply sufficient for those for whose use it is intended; but, as many members of the Society cannot be supposed to be conversant in nautical affairs, I will take the liberty of making a few additional observations on the subject.

It is well known, that a vessel sailing due North or South, makes all latitude; due East or West, all longitude; between any two quarters, both latitude and longitude, according to the course sailed; the two first cases speak for themselves; in the third, recourse must be had to some mode of calculation, of which there are several in use, all of them requiring time, and, as must be the case where many figures are employed, subject to error. The requisite information is obtained by referring to the right hand table, where, by placing the scale on the course sailed, will be seen how much latitude and how much longitude has been made on any given distance; as, in the first example, forty-seven miles on a course of two points and a quarter gives forty-two and a half of latitude,

latitude, and twenty of *apparent* longitude, by seamen termed *departure*. It remains to find how much *actual* or geographical longitude is contained in the apparent longitude, which has been just ascertained; for, inasmuch as the degrees of longitude narrow as we approach the poles, it follows that the longitude varies according to the distance from the equator; for this purpose, a fresh calculation must be resorted to, the necessity for which is obviated by the left hand table, when the longitude being geographically marked out according to the figure of the globe, I have only to place my scale on the degree of latitude in which I have been sailing to find the actual longitude comprised in the apparent longitude or departure, which has been just ascertained; as, in the second example, twenty miles of apparent longitude or departure in latitude sixty, gives forty miles of real or geographical longitude. On the same principles, and with equal facility by these tables alone, all the ordinary business of navigation may be performed.

*** It will not be irrelevant to the subject here to observe, that, though the Society, on all occasions, are extremely anxious to convey to the public, in as clear and concise a manner as possible, the nature and utility of the different inventions they reward, they nevertheless do not *always* accompany the description with an engraving. There are cases in which the Society consider a written communication perfectly elucidatory of the subject, and there are others, *particularly when an engraving of an invention has been previously published*, when they do not deem a descriptive plate necessary. The papers accompanying Mr. Pering's invention are so satisfactory,

and

and so much evince the utility of his "Expeditious Navigator," that the Society have dispensed with an engraving:—a circumstance which, they are inclined to think, will not be regretted, when it is known that the tables are published on a larger scale than *they* could have embraced, by Mr. Carey, Mapseller, in the strand.

On preventing Hares and Rabbits from attacking the Bark of Trees.

By JOSEPH SMEALL, *Gardener at Millburn-Tower.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

WHEN I came to Mr. Liston's service six years ago, I found that the young apple and pear trees which had been previously planted in the garden, were much injured by hares and rabbits eating the bark during the winter season. I endeavoured to find out a remedy, and am happy to think that I have completely succeeded. It is very simple, and attended with little expense, and I beg leave to communicate it to you, for the benefit of the members of the Society.

Take hog's-lard, and as much whale oil as will work it up to a thin paste or paint. With this, gently rub the stems of the trees upwards, at the fall of the leaf. This may be done once in two years, and will be found effectually to prevent either hares or rabbits from touching them.

The innocent nature of the ingredients of which the composition is made, renders it unnecessary for me to say, that the trees are not injured by the application in the slightest degree.

On preventing the Mildew on Peach Trees.

By James Kikk, *Gardener at Smeaton.*

From the Transactions of the Caledonian Horticultural Society.

I BEG leave to submit the following observations, to the Horticultural Society, on the mildew upon peach trees.

For more than nine years I have not had a mildewed leaf on any of the numerous peach trees that are in the garden of the Honourable Mr. Baron Hepburn, at Smeaton, either in the hot-houses or upon the open wall.

I ascribe this exemption from mildew to my mode of management; which is this: In the months of January and February, if I see any of the trees in a stunted or sickly state, I take away all the old mould from the roots as carefully as possible, and put in its place fresh rotten turf from an old pasture, without any dung. This I have done in many instances; and all the times that I have practised it the trees have never failed, not only completely to recover their health, but to produce a crop of fine swelled fruit.

Precautions to be observed in the Employment of Alcohol in Analyses. By M. Grothuss.

Extracted from the Journal de Schweigger.

SEVERAL chemists, in making analyses of mineral waters, have obtained *anomalous* salts, that is to say, salts which reciprocally decompose each other in water, and which consequently cannot exist in it at the same time. Thus, Westrumb extracted sulphate of soda and chlorure of

of magnesium, from the mineral water of Dryburg, and Lavoisier from that of the sea of Dieppe, although these two salts mutually decompose each other when they are in solution in water. But this anomaly takes place according to the nature of the solvent employed to separate the salts, as the following experiment will shew. Make a mixture of sulphate of magnesia and chlorure of sodium dried, and boil them with alcohol; you will find that this liquid holds chlorure of magnesium in solution. By repeating this operation a certain number of times, the last result, if the proportion of salts employed be suitable, will be only sulphate of soda and chlorure of magnesium. However, if these two salts are dissolved in water, by evaporation you will reproduce sulphate of magnesia and chlorure of sodium. A mixture of sulphate of lime and chlorure of sodium gives also, when treated with alcohol, chlorure of calcium and sulphate of soda. From these facts, it is more than probable that the sulphate of soda and chlorure of magnesium, obtained by chemists in the analysis of mineral waters, are formed at the time of the treatment of the saline residuum by alcohol, and that they do not exist primitively in these waters.

Observations on the above, from the Annales de Chemie, by G. L.

According to the rule of M. Berthollet, that the reciprocal decomposition of two salts depends on the relative insolubility in the solvent in which they are found, the preceding experiments are quite naturally explained; for he has considered solvents, in his *Statistique Chimique*, in a general way; and what he has said of wate applies equally to alcohol and other liquids. But it is not

not upon this subject that we are now going to observe; it is on the nature of the salts that are formed at the same time in a solvent, which is sufficient in quantity to hold in solution all that may be formed therein, by making all possible permutations between the bases and the acids.

M. de Grothuss seems to admit in principle that the salts exist in a solvent in the state in which they are obtained when the solvent abandons them by evaporation, and it is for this reason that he designates as *anomalous salts*, the sulphate of soda and chlorure of magnesium, which several chemists have announced to exist in some waters, because these two salts change to sulphate of magnesia and chlorure of sodium when their aqueous solution is evaporated. But we shall first remark, that if sulphate of magnesia and chlorure of sodium be obtained by the evaporation of water containing sulphuric acid, hydro-chlorique acid, soda, and magnesia, the contrary takes place, according to the experiments of Scheele and Green, (Journal des Mines, vol. V. p. 163,) that is to say, that they obtain sulphate of soda and chlorure of magnesium when the temperature is at 0°, or near this term.

This curious result is a consequence of the law established by M. Berthollet, upon the mutual decomposition of salts, because the relative degree of solubility of the four salts that can form with the two acids and the two bases, of which we have been speaking, change with the temperature. Now, if different salts have been obtained with the same elements by effecting the chrystallisation at different temperatures, we can no longer admit that the salts existed in their solvents in the state that they were obtained by evaporation. It may, perhaps, be said, that the exchange of the bases and acids precedes the

the separation of the salts from their dissolvent; but nothing proves this assertion. Whilst the salts are in solution, in a sufficient quantity of liquid, it is not necessary to conceive their elements combined in such order as they may be, for it is always the salt that is least soluble, least fusible, least volatile, or most efflorescent, which, under the *actual circumstances*, separates the first. In fact, we conceive that if the acid and alkaline molecules combine indifferently with each other, any cause that acts in an unequal manner upon the various saline molecules that is possible to suppose in the dissolvent, will necessarily determine a separation.

We cannot, therefore, establish the principle, that the salts which separate first from a dissolvent exist in it in the state in which they are obtained; and since the mutual exchange between the bases and the acids appears to be determined by the slightest circumstances, we conclude, that in order to imitate a mineral water, we may take, indifferently, either the salts that a particular method of analysis demonstrates immediately, or those that may be formed by combining their elements in any other manner. For instance, if we find in one water sulphate of magnesia and chlorure of sodium, this water may be completely imitated, by dissolving in it the sulphate of soda and the chlorure of magnesium proceeding from the mutual decomposition of the two first salts.

Southwark Bridge.

MR. WYATT has received a letter signed *Verbum Sat*, telling him, as the projector of the Southwark Bridge, (which the writer is pleased to say will add everlasting honour to Mr. Wyatt's name,) that it is become his duty to honour

honour his country by changing the name to that of "Trafalgar," and stating, among others, the following reasons: That "the structure and the victory, each the most remarkable of its kind, will reciprocally reflect glory on each other. Within view of the greatest maritime resort in Britain, the site is peculiarly adapted to gratify the veterans who have fought their country's battles, and to excite the most patriotic emulation in the bosoms of our youthful tars—gracing the emporium of the world, every tide will bear to all the quarters of the earth, recorders of the fight."

This alteration was proposed at the last General Meeting of the Proprietors, by Sir Joseph Yorke, with great elegance and force of argument, but was opposed by some of the Members of the Committee, and others, and finally rejected by the company at large. The arguments on both sides were ably supported. But as the decision was against the alteration, Mr. Wyatt (with deference to the writer of the letter) does not think it his duty to attempt now to unsettle the opinion of the majority of the Proprietors, especially as it had not the approbation of Messrs. Pott and Messrs. Barclay and Perkins, by whose cordial assistance he was enabled to establish a bridge in that situation, and without which he would have been foiled in his attempt to accomplish it.

*** The Editors have read Mr. Chapman's work upon the Dry Rot, and recommend it to the attention of all persons concerned in Shipping.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLXXXVI. SECOND SERIES. Nov. 1817.

Specification of the Patent granted to David Brewster, *of Edinburgh, Doctor of Laws; for a new Optical Instrument, called* "The Kaleidoscope," *for exhibiting and creating beautiful Forms and Patterns, of great use in all the ornamental Arts.* Dated July 10, 1817.

With two Wood Engravings.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said David Brewster do hereby declare that the nature of my said invention, and in what manner the same is to be performed, are particularly described and ascertained in manner following; that is to say: The Kaleidoscope (from καλος beautiful, ειδος a form, and σκοπεω to see) is an instrument for creating and exhibiting an infinite variety of beautiful forms, and is constructed in such a manner as either to please the eye, by an ever-varying succession of splendid tints and symmetrical forms, or to enable the observer to render permanent such as may appear most appropriate for any of the numerous branches of the ornamental arts. This instrument, in its most common form, consists of two reflecting

surfaces inclined to each other, at any angle, but more properly at an angle which is an aliquot part of 360°. The reflecting surfaces may be two plates of glass, plain or quicksilvered, or two metallic surfaces, or the two inner surfaces of a solid prism of glass or rock chrystal, from which the light suffers total reflection. The plates should vary in length according to the focal distance of the eye; five, six, seven, eight, nine, and ten inches will in general be most convenient, or they may be made only one, two, three, or four inches long, provided distinct vision is obtained at one end, by placing at the other end an eye-glass, whose focal length is equal to the length of the reflecting planes. The inclination of the reflectors that is in general most pleasing, is 18°, 20°, or 22½°, or the 20th, 18th, and 16th part of a circle, but the planes may be set at any required angle, either by a metallic, a paper, or cloth joint, or any other simple contrivance. When the two planes are put together, with their straightest and smoothest edge in contact, they will have the form shewn in Fig. 1, where A B C is the aperture or angle formed by the plates. In this figure the plates are rectangular, but it may often be more convenient to give them the triangular form, shewn at M, Fig. 2, or N, Fig. 3.

Fig. 1.

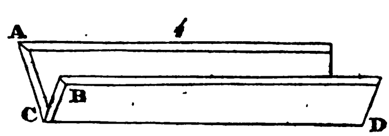


Fig. 2.

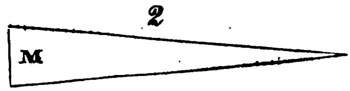
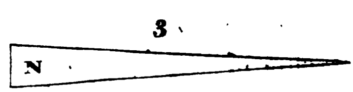


Fig. 3.



When

When the instrument is thus constructed, it may be either covered up with paper or leather, or placed in a cylindrical, or any other tube, so that the aperture A B C may be left completely open, and also a small aperture at the angular point D. If the eye is now placed at D, and looks through the aperture A B C, it will perceive a brilliant circle of light, divided into as many sectors as the number of times that the angle of the reflectors is contained in 360°. If this angle is 18°, the number of sectors will be 20°: and, whatever be the form of the aperture A B C, the luminous space seen through the instrument will be a figure produced by the arrangement of twenty of these apertures round C, as a centre, in consequence of the successive reflections between the polished surfaces. Hence it follows, that if any object, however ugly or irregular in itself, is placed before the aperture A B C, the part of it that can be seen through the aperture will be seen also in every sector, and every image of the object will coalesce into a form mathematically symmetrical, and highly pleasing to the eye. If the object is put in motion, the combination of images will likewise be put in motion, and new forms, perfectly different, but equally symmetrical, will successively present themselves, sometimes vanishing in the centre, sometimes emerging from it, and sometimes playing around in double and opposite oscillations. When the object is tinged with different colours, the most beautiful tints are developed in succession, and the whole figure delights the eye by the perfection of its forms and the brilliancy of its colouring. The motion of the object may be effected either by the hand or by a simple piece of mechanism, or the same effect may be produced by the motion of the instrument over the object, or round its own axis. In the form of the kaleidoscope now described, the object should be held

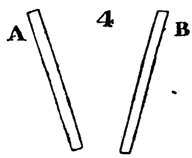
close to the aperture A B C, and the eye should be placed as nearly as possible in the line C D; for the figure loses its symmetry in proportion as the object recedes from A B C, and as the eye rises above D. The instrument is therefore limited in its present form to the use of objects, which can be held close to the aperture. In order to remove the limitation, the tube which contains the reflectors should slide in another tube, of nearly the same length, and having a convex lens at its farther extremity, the focal length of the lens should be always less than its greatest distance from the aperture A B C. In general it should be about one-third or one-fourth of that distance, but it will be advisable to have two or even three lenses of different focal lengths, to fit into the end of the outer tube, and to be used as circumstances may require, or a variation of focal length may be produced by the separation or approach of two lenses. When the instrument is thus fitted up, it may be applied to objects at all distances; and these objects, whose images are formed in an inverted position at the aperture A B C, may be introduced into the symmetrical picture in the very same manner as if they were brought close to the instrument. Hence we can introduce trees, flowers, statues, and living animals; and any object which is too large to be comprehended by the aperture A B C may be removed to such a distance that its image is sufficiently reduced. The Kaleidoscope is also constructed with three or more reflecting planes, which may be arranged in various ways. The tints placed before the aperture may be the complimentary colours produced by transmitting polarised light through regularly chrystallised bodies or pieces of glass that have received the polarising structure. The partial polarisation of the light, by successive reflections, occasions a partial analysis of the transmitted light; but in

order

order to develope the tints with brilliancy, the analysis of the light must precede its admission into the aperture. Instead of looking through the extremity D of the tube, the effects which have been described may be exhibited to many persons at once, upon the principle of the solar microscope or magic-lanthorn; and in this way, or by the application of the camera lucida, the figures may be accurately delineated. It would be an endless task to point out the various purposes in the ornamental arts to which the Kaleidoscope is applicable. It may be sufficient to state, that it will be of great use to architects, ornamental painters, plasterers, jewellers, carvers and gilders, cabinet-makers, wire-workers, book-binders, calico-printers, carpet manufacturers, manufacturers of pottery, and every other profession in which ornamental patterns are required. The painter may introduce the very colours which he is to use, the jeweller the jewels which he is to arrange, and in general the artist may apply to the instrument the materials which he is to embody, and thus form the most correct opinion of their effect when combined into an ornamental pattern. When the instrument is thus applied, an infinity of patterns are created, and the artist can select such as he considers most suitable to his work. When a knowledge of the nature and powers of the instrument has been acquired by a little practice, he will be able to give any character to the pattern that he chooses, and he may even create a series of different patterns, all rising out of one another, and returning by similar gradations to the first pattern of the series. In all these cases the pattern is perfectly symmetrical round a centre, or all the images of the aperture A B C are exactly alike; but this symmetry may be altered, for after the pattern is drawn it may be reduced into a square, a triangular, an elliptical, or any other

other form that we please. The instrument will give annular patterns, by keeping the reflectors separate, as at A B, Fig. 4, and it will give rectilineal ones, by placing the reflectors parallel to each other, as in Fig. 5.

Fig. 4.



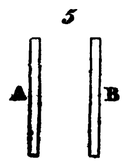


Fig. 5.

The Kaleidoscope is also proposed as an instrument of amusement, to please the eye, by the creation and exhibition of beautiful forms, in the same manner as the ear is delighted by the combination of musical sounds. When Custillon proposed the construction of an ocular harpsichord, he was mistaken in supposing that any combination of harmonic colours could afford pleasure to the person who viewed them; for it is only when these colours are connected with regular and beautiful forms that the eye is gratified by the combination. The Kaleidoscope, therefore, seems to realise the idea of an ocular harpsichord. In witness whereof, &c.

Specification of the Patent granted to JOHN ASTON WILKES, *in the County of Warwick, Glass-manufacturer; for a Method of manufacturing Glass Icicles, Spangles, and every other Description of ornamental Glass-work, with a Loop or Loops of the same Material.*

Dated September 30, 1816.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Aston Wilkes do hereby declare that the nature of my said invention, and the manner in which the

the same is to be performed, is particularly described and ascertained in manner following; that is to say: My specification is for the manufacturing of icicles, spangles, and every other description of ornament peculiar to glass chandelier furniture, with a loop or loops of the same material, which loop or loops may be attached by heat to any of the said articles after they are completed in other respects, either in part or the whole. This process may be effected by any of those methods by which two separate pieces of glass, with the assistance of heat, are united to each other, but I have found it most conveniently accomplished in the following manner. The article to which the loop is intended to be affixed being cut and polished, either completely or partially, as its form or bulk may render expedient, is cautiously exposed by the workman to the stream of a common blowpipe with one hand, whilst with the other he attaches to its softened extremity or edge a small portion of flint or any other coloured glass, which when sufficiently hot, he presses flat with a pair of plyers, or any other tool. This done, it is again heated quite soft, and immediately perforated with a piercing tool of iron, or any other metal. The loop thus formed being finally rendered circular in its shape, and smooth in its surface, by the combined employment of the blow-pipe and piercing tool; or the glass loop may be manufactured separately, either in dies or by winding a filament of softened glass round a wire, as is done in making a certain description of beads, called lapped beads, which may or may not be cut and polished like the article with which it is to be united, and then attached by heat to any of the various species of glass chandelier furniture, either with or without the interposition of a third portion of glass.

In witness whereof, &c.

Specification

Specification of the Patent granted to John Hague, *of Great Pearl-street, Spitalfields, in the County of Middlesex, Engineer; for certain Improvements in the Method of expelling Molasses or Syrup from Sugars.*

Dated July 27, 1816.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said John Hague do hereby declare that my invention consists in expelling the molasses from sugar by occasioning a pressure of the atmosphere on a surface of the sugar: and this I do either by withdrawing the air from the under surface, or by compressing the air on the upper surface of the sugar. When I do it by the first method, that of withdrawing the air from the under surface, I make use of a trough or box, (open at the top,) either square, round, or any other proper shape. I prefer having it larger at top than at bottom, in order that when the sugar shrinks by the expulsion of the molasses it may by sinking, keep tight round the sides, and thereby prevent the rapid passage of the air between the sugar and the sides of the trough or box. In this trough or box, at a few inches, or any proper height from its real bottom, I put a false bottom, made of any proper material, (but I prefer sheet copper,) and thickly perforated with small holes. On this false bottom I place a cloth or web, made of hair or some other material; and on the cloth or web I put the sugar that is to be operated upon, which I previously moisten regularly with water, lime-water, or some other liquid. To the real bottom or sides of the above-described trough or box I fix one end of a pipe or tube; the other end of which I fix to the upper side, or some other part of a receiving vessel, placed at a convenient distance below the trough or box. This receiving vessel I furnish

I furnish with a cock, or some other contrivance, for the convenience of drawing off the molasses when desirable or necessary. From some part of the above-described pipe or tube I branch off a tubular arm, which leads to an air-pump, fixed at any distance from the already-described apparatus. The construction of an air-pump is so well understood by mechanical persons, that it needs not here being more particularly described. The operation by this method is as follows: having prepared the sugar, by moistening it with water or some liquid, as before described, I then spread it about three inches deep, or any other proper depth, all over the cloth or web that covers the false bottom of the trough or box, taking care that the sugar comes close to the sides of the trough or box all round; next, by means of a water-wheel, windmill, steam-engine, animal strength, or other power, I set the air-pump to work, which partially exhausts the air from the other parts of the apparatus. A partial vacuum being thus formed underneath the false bottom of the trough or box, the pressure of the atmosphere and the passage of the air through the sugar separates and expels the molasses, which passing through the cloth or web, and the perforations in the false bottom, falls on the real bottom of the trough or box, and is from thence conducted by the pipe or tube into the receiving vessel below. This operation I continue by keeping the air-pump at work until the molasses is sufficiently expelled from the sugar. When I do it by the other method, that of compressing the air on the upper surface, I make use of a trough or box, covered on the top, which I furnish with a false bottom and cloth, or web, as by the first method. The expelled molasses I convey from this trough or box through an aperture, pipe, or tube, to any vessel or place destined to receive it.

The operation by this method is as follows. Having prepared and spread on the cloth or web the sugar to be operated upon as by the former method, I, by means of a force-pump, bellows, or some other contrivance, worked by some power, either natural or artificial, compress the air on the upper surface of the sugar, which produces the same effect on it as the operation first described.

In witness whereof, &c.

Specification of the Patent granted to JOHN MANTON, *of Dover-street, in the Parish of Saint George, Hanover-square, in the County of Middlesex, Gunmaker; for an improved Lock for Guns and Pistols.*

Dated December 11, 1810.

With a Wood Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Manton do hereby declare that my said invention is described in the plan or drawings in the margin of these presents, and the description thereof hereunder written; that is to say: The drawing Fig. 1 shews the outside of the lock when at half-cock, Fig. 2 the outside when struck down, and Fig. 3 the plan of the inside. Letters A represent the outside of the pan; B the hammer; C the cock; D the pin or screw which confines the hammer and hammer spring, and on which the hammer acts; E the inside end of the pan which comes opposite the touch-hole: the hammer B acting downwards, opens that side of the pan nearest to the cock C, to admit the sparks to the prime. The manner of its opening is described in the drawing Fig. 2. The hammer, returning to its jointing, fills up the opening in the

pan.

pan. The hammer is furnished with a strong steel face, fastened by a stud in the back, and a small screw through the hammer. At the end of the hammer-face nearest the pan is a small groove or notch, sunk in the hammer to carry off any wet that may come down upon it. The hammer is fixed to the plate by the same screw D, that fastens the hammer-spring on the inside. The hole in the shank of the hammer being screwed, it turns on the hammer spring pin D, which comes through the plate about three-eighths of an inch. There is a projection on the inside of the hammer spring one fourth of an inch long, which comes through a square hole in the plate into a hole in the shank of the hammer, and forces it to return to its jointing with the pan when the lock is brought to half-cock. The cock C is flat on the inside, and is barely one-eighth of an inch thick. It passes between the plate and the hammer when it comes down. The jaws project outwards, to answer the hammer. A bulge is left on the breast of the cock, to render the fitting of the squares of the tumbler more strong and perfect. When the lock is struck down the flint comes in contact with the hammer face near the end, and forces it down sufficiently to admit the sparks into the pan. The pan is three-fourths or seven-eighths of an inch long from the outside of the plate.

The drawing, Fig. 3, shews the inside of the lock, so very plain and clear that it cannot be misunderstood by any lock-maker. The inside of the pan E is round, and the same size from end to end. About one-third is cut out to receive part of the hammer, as described in the drawing Fig. 1. The main spring has a stud, like others. The end of the stud side is bevelled, to fit under the end of the rib, by which it is prevented from rising. The crane of the tumbler has a roller in the end, on which

the main spring acts. The bridle has a strong leg on the inside, with a round stud, which fits into the plate near the sear nose, to prevent it from twisting when the tumbler comes in contact with the eye to stop the cock. The sear acts on the tumbler in the usual way, but the shank is nearly vertical instead of horizontal, as they are in general. The sear spring acts in a shoulder left on the outside of the sear for that purpose, and forces the sear nose to the tumbler. The pan of this lock is primed from the touch-hole by the compression of the air in loading.

The following are the principal advantages derived from this improved lock.

First. The pan being solid with the plate at top, protects the prime from wet.

Secondly. The hammer opening downwards, and the flint acting in a direct line with the pan, the sparks communicate quicker to the prime.

Thirdly. The hammer returns to its jointing with the pan when the lock is brought to half-cock, without any additional trouble to the user.

Fourthly. The lowness and compactness of the lock altogether, renders it much less difficult to protect from wet, and much less liable to accidents, by catching in cover shooting than locks of the present construction.

In witness whereof, &c.

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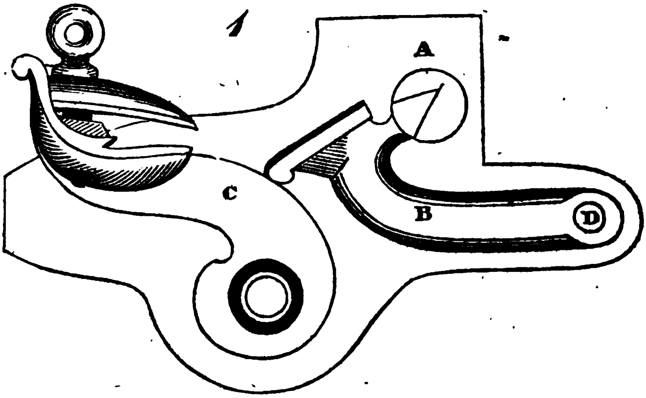

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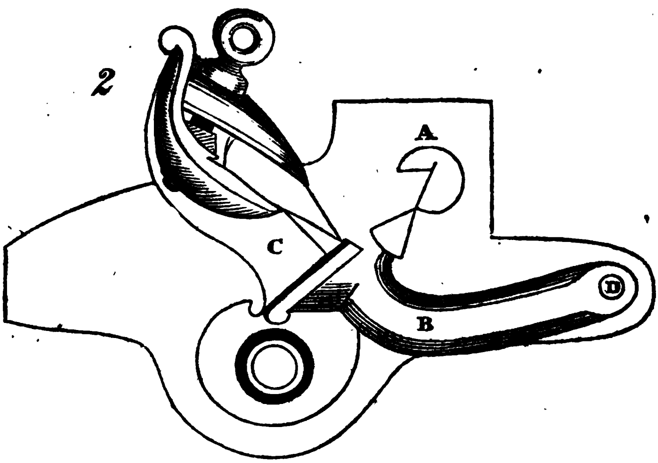

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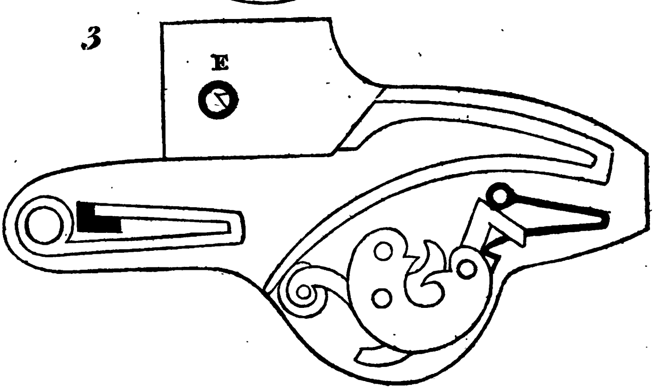


Method of propelling Steam Boats.

By Mr. JONATHAN DICKSON, *of Holland-street, Blackfriars.*

With a Plate.

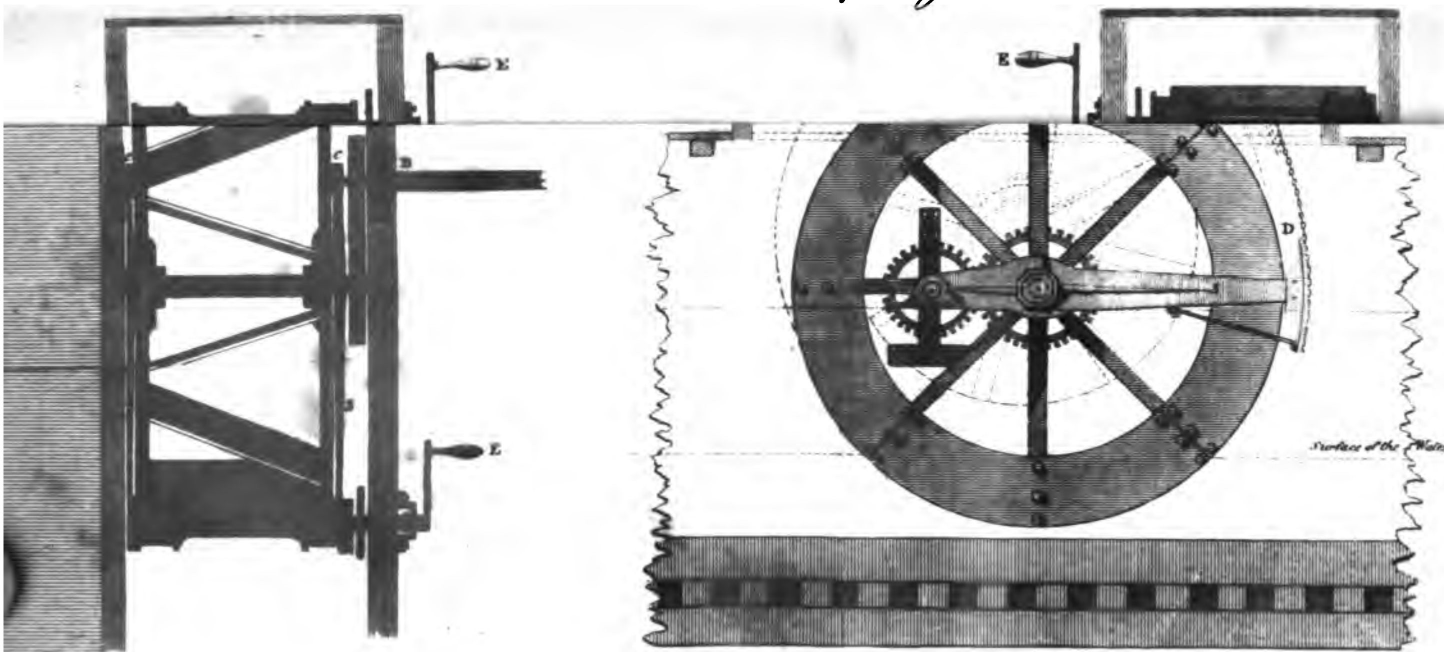
From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal was voted to Mr. DICKSON *for this Communication.*

AS steam vessels are now about to come into general use, it has been recommended to me by some of my friends to take out a patent for this improvement, and by others to lay it before the Society of Arts. I hereby acquiese in the latter recommendation, and presume, that the Society will easily perceive its great utility, and that it is likely to become a national concern. It has met with general approbation, and it is considered that few steam vessels ought to be without it. I have to add, that it is purely an idea of my own; that it has not ever been used: that I made the model of it twelve months ago, and I am now applying it to a steam vessel of large dimensions.

This improvement consists in a method of raising and lowering the propelling wheels, or their apparatus, while they are in motion, without stopping the engine or any part of the machinery, and thereby allowed to enter so deep into the water as may be found necessary for propelling the vessel at its intended velocity. This is accomplished by means of an eccentric or planetary motion being given to the second motion of the machinery, which enables it to move partly round the first motion or driving power. In the model I have applied a screw to raise the levers

Mr. Dickson's Method of Propelling Steam Boats.



levers which carry the propellers, but it can be done either by a pinion working in a segment of a wheel, whose radius is equal to the length of the lever, or a common rack and pinion, or endless chain, which last is likely to be the most convenient. All steam vessels, hitherto in use, have suffered a great inconvenience owing to their propelling wheels being fixed to a certain depth in the water, and having no means of relieving them according to the load they have to carry, but the great utility of this improvement will hereafter be found by those steam vessels that may carry sails, and perhaps be the only means of enabling steam vessels to proceed to sea; for instance, suppose a steam vessel to be going direct against the wind by means of the whole power of her steam-engine, and that the wind should change and become favourable, the propellers may by these means be immediately raised out of the water, and the vessel allowed to have the whole effect of the sails, thereby saving the expense of fuel. All steam vessels now in use experience so great an impediment from the propellers being always in the water, as to render sails of no use. Another advantage will be derived when there is only a gentle breeze in the vessel's favour, as the propellers can be set to work, which will take hold of the water at pleasure, and thereby unite the power of the steam to that of the wind, which will secure the passage in the given time, at much less expense, as the engine will only consume fuel in proportion to the labour it has to perform. A farther advantage will be found when the vessel has only a side wind, for, by the use of this contrivance, one of the propelling wheels can be worked with its full power in the water, and the other entirely lifted out, if necessary (still the whole kept in motion, and thereby the direct course of the vessel be maintained). A still farther advantage may be derived from

from the use of this improvement, when a vessel might meet with the loss of her rudder; for, by the propellers being worked on this plan, the vessel may be steered as well without the rudder, as either of the propellers may be raised or lowered immediately, and thereby the course of the vesel varied. The use of the propellers upon this plan will be conspicuously advantageous where a sudden tack is necessary, (perhaps to save the vessel,) as she could be turned nearly upon her centre at pleasure.

I have thus endeavoured to point out a few of the advantages which this improvement possesses.

Some new Experiments and Observations on the Combustion of Gaseous Mixtures, with an Account of a Method of preserving a continued Light in Mixtures of inflammable Gases and Air without Flame.

By Sir Humphry Davy, *LL.D. F.R.S. V.P.R.I.*

With a Wood Engraving.

From the Philosophical Transactions of the Royal Society of London.

In a Paper read before the Royal Society at their last two meetings, I have described the phenomena of the slow combustion of hydrogen and olefiant gas without flame. In the same paper I have shown, that the temperature of flame is infinitely higher than that necessary for the ignition of solid bodies. It appeared to me, therefore, probable, that in certain combinations of gaseous bodies, for instance, those above referred to, when the increase of temperature was not sufficient to render the gaseous matters themselves luminous; yet still it might be adequate to ignite solid matters exposed to them. I had devised several experiments on this subject. I had intended

intended to expose fine wires to oxygen and olefiant gas, and to oxygen and hydrogen during their slow combination under different circumstances, when I was accidentally led to the knowledge of the *fact*, and, at the same time, to the discovery of a new and curious series of phenomena.

I was making experiments on the increase of the limits of the combustibility of gaseous mixtures of coal gas and air by increase of temperature. For this purpose, I introduced a small wire-gauze safe-lamp with some fine wire of platinum fixed above the flame, into a combustible mixture containing the maximum of coal gas, and when the inflammation had taken place in the wire-gauze cylinder, I threw in more coal gas, expecting that the heat acquired by the mixed gas in passing through the wire-gauze would prevent the excess from extinguishing the flame. The flame continued for two or three seconds after the coal gas was introduced; and when it was extinguished, that part of the wire of platinum which had been hottest remained ignited, and continued so for many minutes, and when it was removed into a dark room, it was evident that there was no flame in the cylinder.

It was immediately obvious that this was the result which I had hoped to attain by other methods, and that the oxygen and coal gas in contact with the hot wire combined without flame, and yet produced heat enough to preserve the wire ignited, and to keep up their own combustion. I proved the truth of this conclusion by making a similar mixture, heating a fine wire of platinum and introducing it into the mixture. It immediately became ignited nearly to whiteness, as if it had been itself in actual combustion, and continued glowing for a long

 while,

while, and when it was extinguished, the inflammability of the mixture was found entirely destroyed.

A temperature much below ignition only was necessary for producing this curious phenomenon, and the wire was repeatedly taken out and cooled in the atmosphere till it ceased to be visibly red; and yet when admitted again, it instantly became red hot.

The same phenomena were produced with mixtures of olefiant gas and air. Carbonic oxyd, prussic gas and hydrogen, and in the last case with a rapid production of water; and the degree of heat I found could be regulated by the thickness of the wire. The wire, when of the same thickness, became more ignited in hydrogen, than in mixtures of olefiant gas, and more in mixtures of olefiant gas than in those of gaseous oxyd of carbon.

When the wire was very fine, about the $\frac{1}{80}$ of an inch in diameter, its heat increased in very combustible mixtures, so as to explode them. The same wire in less combustible mixtures only continued bright red, or dull red, according to the nature of the mixture.

In mixtures not explosive by flame within certain limits, these curious phenomena took place whether the air or the inflammable gas was in excess.

The same circumstance occurred with certain inflammable vapours. I have tried those of ether, alcohol, oil of turpentine, and naphtha. There cannot be a better mode of illustrating the fact, than by an experiment on the vapour of ether or of alcohol, which any person may make in a minute. Let a drop of ether be thrown into a cold glass, or a drop of alcohol into a warm one. Let a few coils of wire of platinum of the $\frac{1}{60}$ or $\frac{1}{70}$ of an inch be heated at a hot poker or a candle, and let it be brought into the glass; it will in some part of the glass become glowing, almost white hot, and will continue so as long

as

as a sufficient quantity of vapour and of air remain in the glass.

When the experiment on the slow combustion of ether is made in the dark, a pale phosphorescent light is perceived above the wire, which of course is most distinct when the wire ceases to be ignited. This appearance is connected with the formation of a peculiar acrid volatile substance possessed of acid properties.

The chemical changes in general produced by slow combustion appear worthy of investigation. A wire of platinum introduced under the usual circumstances into a mixture of prussic gas (cyanogen) and oxygen in excess became ignited to whiteness, and the yellow vapours of nitrous acid were observed in the mixture. And in a mixture of olefiant gas non explosive from the excess of inflammable gas, much carbonic oxyd was formed.

I have tried to produce these phenomena with various metals; but I have succeeded only with platinum and palladium; with copper, silver, iron, gold, and zinc, the effect is not produced. Platinum and palladium have low conducting powers, and small capacities for heat compared with other metals, and these seem to be the principal causes of their producing, continuing, and rendering sensible these slow combustions.

I have tried some earthy substances which are bad conductors of heat; but their capacities and power of radiating heat appear to interfere. A thin film of carbonaceous matter entirely destroys the igniting power of platinum, and a slight coating of sulphuret deprives palladium of this property, which must principally depend upon their increasing the power of the metals to radiate heat.

Thin laminæ of the metals, if their form admits of a free circulation of air, answer as well as fine wires; and

 a large

a large surface of platinum may be made red hot in the vapour of ether, or in a combustible mixture of coal gas and air.

I need not dwell upon the connection of these facts respecting slow combustion, with the other facts I have described in the history of flame. Many theoretical views will arise from this connection, and hints for new researches, which I hope to be able to pursue in another communication. I shall now conclude by a practical application. By hanging some coils of fine wire of platinum, or a fine sheet of platinum or palladium above the wick of his lamp, in the wire-gauze cylinder, the coal miner, there is every reason to believe, will be supplied with light in mixtures of fire-damp no longer explosive; and should his flame be extinguished by the quantity of fire-damp, the glow of the metal will continue to guide him, and by placing the lamp in different parts of the gallery, the relative brightness of the wire will show the state of the atmosphere in these parts. Nor can there be any danger with respect to respiration whenever the wire continues ignited, for even this phenomenon ceases when the foul air forms about $\frac{2}{5}$ of the volume of the atmosphere.

I introduced into a wire-gauze safe-lamp a small cage made of fine wire of platinum of the $\frac{1}{70}$ of an inch in thickness, and fixed it by means of a thick wire of platinum about two inches above the wick which was lighted. I placed the whole apparatus in a large receiver, in which, by means of a gas holder, the air could be contaminated to any extent with coal gas. As soon as there was a slight admixture of coal gas, the platinum became ignited; the ignition continued to increase till the flame of the wick was extinguished, and till the whole cylinder became filled with flame; it then diminished. When the

 quantity

quantity of coal gas was increased so as to extinguish the flame; at the moment of the extinction the cage of platinum became white hot, and presented a most brilliant light. By increasing the quantity of the coal gas still farther, the ignition of the platinum became less vivid. When its light was barely sensible, small quantities of air were admitted, its heat speedily increased; and by regulating the admission of coal gas and air it again became white hot, and soon after lighted the flame in the cylinder, which as usual, by the addition of more atmospherical air, re-kindled the flame of the wick.

This experiment has been very often repeated, and always with the same results. When the wire for the support of the cage, whether of platinum, silver, or copper, was very thick, it retained sufficient heat to enable the fine platinum wire to re-kindle in a proper mixture a half a minute after its light had been entirely destroyed by an atmosphere of pure coal gas; and by increasing its thickness the period might be made still longer.

The phenomenon of the ignition of the platinum takes place feebly in a mixture consisting of two of air and one of coal gas, and brilliantly in a mixture consisting of three of air and one of coal gas: the greater the quantity of heat produced the greater may be the quantity of the coal gas, so that a large tissue of wire will burn in a more inflammable mixture than single filaments, and a wire made white hot will burn in a more inflammable mixture than one made red hot. If a mixture of three parts of air and one of fire damp be introduced into a bottle, and inflamed at its point of contact with the atmosphere, it will not explode, but will burn like a pure inflammable substance. If a fine wire of platinum coiled at its end be slowly passed through the flame, it will continue ignited in the body of the mixture, and the same gaseous matter

ter will be found to be inflammable and to support combustion.

There is every reason to hope that the same phenomena will occur with the cage of platinum in the fire-damp, as those which have been described in its operation on mixtures of coal gas. In trying experiments in fire-damp, the greatest care must be taken that no filament or wire of platinum protrudes on the exterior of the lamp, for this would fire externally an explosive mixture. However small the mass of platinum which kindles an explosive mixture in the safe-lamp, the result is the same as when large masses are used; the force of the explosion is directed to, and the flame arrested by, the whole of the perforated tissue.

When a large cage of wire of platinum is introduced into a very small safe-lamp, even explosive mixtures of fire-damp are burnt without flame; and by placing any cage of platinum in the bottom of the lamp round the wick, the wire is prevented from being smoked. I have sent lamps furnished with this apparatus to be tried in the coal mines of Newcastle and Whitehaven: and I anxiously wait for the accounts of their effects in atmospheres in which no other permanent light can be produced by combustion.

London, Jan, 22, 1817.

Explanation of the Wood Engraving, Page 345, representing different forms of the Miners' Safe-lamp, with the Apparatus for giving Light in explosive Mixtures.

a. represents the single cylinder of wire-gauze; the foldings *a. a. a.* must be very well doubled and fastened by wire. If the cylinder be of twilled wire-gauze, the wire should

should be at least of the thickness of $\frac{1}{40}$ of an inch, and of iron or copper, and 30 in the warp and 16 or 18 in the weft. If of plain wire-gauze, the wire should not be less than $\frac{1}{60}$ of an inch in thickness, and from 28 to 30 both warp and woof.

b. represents the second top which fits upon *a.*

c. represents a cylinder of brass, in which the wire-gauze is fastened by a screw to prevent it from being separated from the lamp by any blow. *c.* is fitted into a female screw, which receives the male screw *β.* of the lamp *f.* *f.* is the lamp furnished with its safe trimmer and safe feeder for oil.

A. is the wire-gauze lamp put together with its strong wire supports, which may be three or four receiving the handle.

J. is a small cage made of wire of platinum, of $\frac{1}{70}$ or $\frac{1}{80}$ of an inch in thickness, fastened to a wire for raising it above the wick, for giving light in inflammable media, containing too little air to be explosive.

h. is a similar cage for placing in the bottom of the lamp, to prevent it from being smoked by the wick.

C. is a lamp of which the cylinder is copper of $\frac{1}{40}$ of an inch in thickness, perforated with longitudinal apertures of not more than the $\frac{1}{16}$ of an inch in length, and the $\frac{1}{30}$ in breadth. In proportion as the copper is thicker, the apertures may be increased in size. This form of a lamp may be proper where such an instrument is only to be occasionally used; but for the general purposes of the collier, wire-gauze, from its flexibility, and the ease with which new cylinders are introduced, is much superior*.

* In the first lamps which I made on this plan, more than twelve months ago, the apertures were circular; but in this case their diameters were required to be very small, as the circular aperture is the most favourable to the transmission of flame.

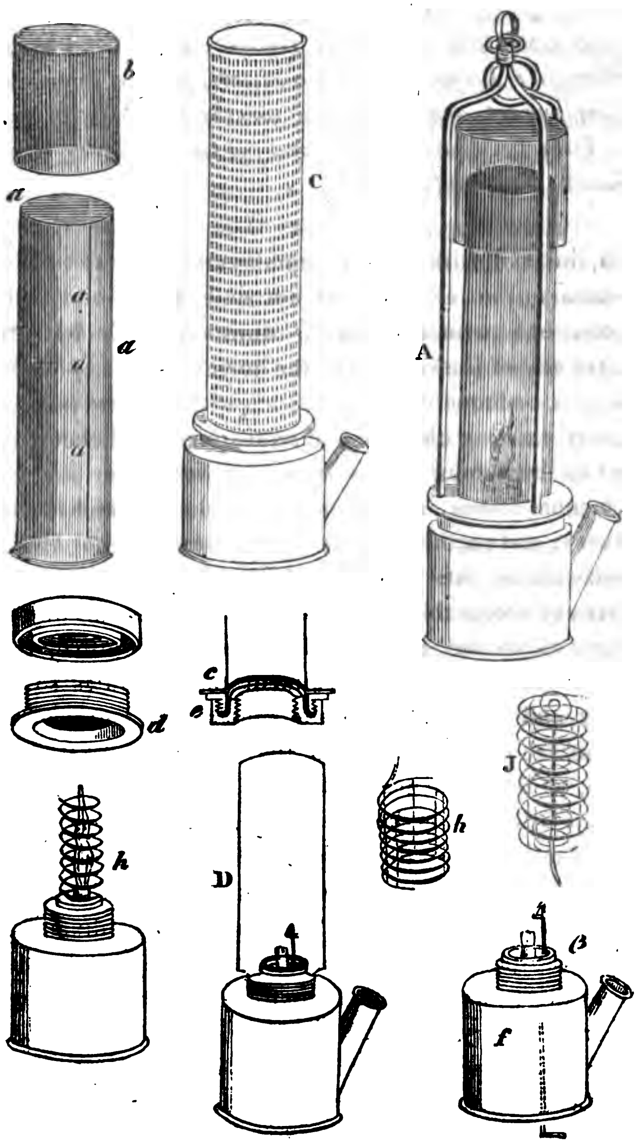
D.

D. is a lamp fitted with a tin-plate mirror of half the circumference of the cylinder, and reaching as high as the single top, which may be used in strong currents of fire-damp to prevent the heat from rising too high.

All these forms of the wire-gauze lamp are equally safe. In the twilled-guaze lamp less fire-damp is burnt, and the radiating and cooling surface is greater, and it is therefore fitted for very explosive mixtures, or for explosive currents. The wire-gauze lamp with a double cylinder, or with a reflector, answers the same purpose.

The general principle is, that the cylinder should in no case be suffered to be heated above dull redness; and this is always effected by increasing the cooling surfaces, or by diminishing the circulation of the air.

I cannot conclude this notice respecting the safe-lamp, without stating, that in the practical application of my views I have received the most enlightened and liberal assistance from the Rev. John Hodgson and Mr. Buddle, who have been the first persons to put my principles to the test of actual experiment in the mines, and to confide their safety to those new resources of chemistry.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On the Operation of the Salt Duties. From Sir Thomas Bernard's Letter to Mr. Vansittart, on the Supply of Employment and Subsistence for the Labouring Classes in Fisheries, Manufactures, and the Cultivation of Waste Lands, &c. 1817.

As the evil (the want of employment) is not local or temporary, the remedy must not only be general in its effects, but permanent in its duration.— Except the greater evil of the renewal of the horrors of war, no measure seems adequate to the object, without the removal of every existing obstacle and impediment to the employment of the labouring classes, so as to augment the call for manual labour, in Agriculture, Fisheries, and Manufactures; and particularly, by the cultivation of our Waste Lands and the extension of our Fisheries, to provide new sources of acceptable occupation. Looking to this object, it appears to me, and I shall endeavour to prove, that there is no obstacle or impediment that operates so generally and fatally against the increase of employment for the labouring classes, in these and many other respects, as the existence of the Salt Duties.

There is hardly to be found in the infinite variety of created matter, any thing more valuable, or more generally applicable to use, than Common Salt. Composed of two deleterious materials, chlorine and sodium, the united substance is more beneficial and salubrious than it is in the power of our limited understanding to comprehend. Every accession of knowledge discovers new benefits and uses in it. Its spirit is diffused over the boundless ocean. It gives health and purity to the mass of waters, and to the inhabitants of the deep abyss. It preserves

preserves every species of food for the use of man, renews the exhausted soil, and restores its fertility, and is healthful and acceptable to every kind of animal. In respect of this important and necessary article of life, England has been peculiarly fortunate. Her brine springs are rich and abundant; and, what is extraordinary, are stronger in proportion as they are more and more worked by the pump. A gallon of brine will yield above two pounds and a half of solid salt; whilst those foreign springs, which are the subject of the French report in 1795, are not of half the strength of the brine springs in the county of Chester. Add to this, that the waters which wash the bays and inlets of our coasts, are capable of producing an inexhaustible supply of salt; and that the subterraneous treasures of coal that abound in every part of our island, afford means which no other country possesses, of purifying and crystallizing it for our own use, for the extension of our commerce, and for the supply of the world. No country, indeed, has been in this respect more favoured, except so far as (like the wand of Sancho's physician), the arm of Government is extended to prevent our free enjoyment of the bounty of Providence.

In preparing the salt from the brine, there is a refuse part, which is formed by the separation and decomposition of the grosser particles from the pure salt. This is cleared out from the pans, and thrown on the ground, to the amount of several bushels * at each boiling. Before

* In his Agricultural Survey of Cheshire, p. 238, Mr. Holland notices an experiment made with this refuse salt, where it was spread, in the middle of October, on a piece of sour rushy ground, after the rate of eight bushels to the acre, and in another part sixteen bushels. In a short time the vegetation disappeared totally; and, during the month of April following, not a blade of grass was

the excessive increase of the duties (which now are thirty pounds on a ton of salt, the original value of which is about fifteen shillings), the salt proprietors were allowed to dispose of this refuse salt to the farmers, who knew the value of it as a manure, and (however inferior it might be to pure salt) were very glad to purchase as much as they could get of it, at twenty-five shillings a ton; half of which went as a duty to Government, and the rest was a clear gain to the salt proprietor. The late Lord Coventry used to have a regular supply of this manure sent from Droitwich to his place at Crome Court; the excise officer attending to see it moved and laid on the land, and receiving a compliment for his extra attendance. The quantity of this manure, which was at one time sold at Northwich alone, to the farmers of that neighbourhood, amounted, as we are informed by Bishop Watson, to near 120,000 bushels annually. This was a very considerable boon to agriculture, and an equal advantage to the salt proprietor and to Government in respect of the duty it paid. But when the duties on salt were still more increased, the disposal of this refuse salt was prohibited, to the great regret of the farmers; the country was deprived of the benefit of a cheap and rich manure, and the whole of this refuse salt is now, under a relentless order, carefully swept up by the proprietor's labourers in the exciseman's presence, and thrown into the river.

In order to promote and encourage the improvement

to be seen. In the latter end of the month of May, a most flourishing crop of rich grass made its appearance on that part where the eight bushels had been laid. In the month of July, the other portion produced a still stronger crop: the cattle were remarkably fond of it; and during the whole ensuing winter, and for several years, the land retained, and yet exhibits, a superior verdure to the neighbouring closes.

of

of waste lands, as an additional source of occupation for the disbanded veteran and unemployed labourer, no measure can be proposed so desirable or effectual, as the removal of the impediments that arise from the duties on salt; the use of which, in agriculture, is now prohibited by a tax of forty times the value of the article. The supply of means for bringing the soil immediately, and with little expense, into produce, affords the best and most effectual encouragement and incitement to the cultivation of waste and unprofitable lands. It is thus that the introduction of lime into our list of manures, has produced, in the course of the last thirty years, the most beneficial and extraordinary effects in this country, by reclaiming millions of acres, hitherto deemed uncultivable. The vicinity of a lime quarry, or the power of communicating with one by water carriage, is marked in every part of England by improved cultivation and increased fertility: yet lime is not so cheap, nor so powerful, nor so universal a manure as salt. Lime must be applied in much larger quantities; the carriage is much more expensive, and there are many parts of England where it cannot be had at a price to answer for the husbandman. But salt, duty free, is a great deal cheaper, and (as far as experiments have gone) very superior in power and permanency of effect; and it is to be easily obtained in all the remote and desert parts of the island, the expense of carriage being comparatively nothing. At the same time, its powerful quality, and the extreme caution required in its application, have occasioned some doubts with regard to its use as a manure. It seems, however, invariably to have answered, when used in the very small quantity of a bushel* to an acre; and when

* I mention one bushel to an acre, on the authority of a gentleman who made a series of experiments on salt as a manure, and held that

used in too great abundance, to have been as destructive of vegetation, as it is friendly to it in small and carefully measured proportions. Bishop Watson accounts for these effects of salt, " when applied as a manure in small quantities, from its efficacy in reducing weeds, dried herbage, dead roots, &c. into a putrid oily mass;" and he goes on to observe, that when salt is used in a larger proportion, it preserves these matters from corruption, and the fertility of the ground is thereby diminished, or wholly destroyed. This may be confirmed and illustrated by reference to Sir John Pringle's Experiments, which prove that common salt, when used in small quantities, accelelerates the putrefaction of animal substances, but when used in larger quantities it retards it. Whatever may be the physical cause, it seems now to be practically ascertained, that salt used in very small quantities, and mixed with loam or mould, is a valuable and powerful manure; but that in large quantities it is pernicious. The fertilizing power of a little salt is alluded to in Scripture; where the extraordinary conversions, to be produced by a few illiterate disciples, are compared to the power of a small portion of salt to fertilize an extent of soil;—" ye are the salt of the earth."

The use of salt as a manure, however, if we were relieved from the duties, would not be confined to waste lands. The practice which existed a few years ago, of applying the refuse salt as a manure, would be renewed, and extended to every part of the kingdom. The farmer would also use the pure and marketable salt, the price of which would not be so much as he formerly paid for refuse salt. Applied in the small quantities I have mentioned,

that the proportion of a bushel to an acre answered best, and made the land most productive. Different proportions, however, may suit different soils.

tioned, and especially when mixed in the compost dung-hill, salt is the best and the cheapest of all manures that can be used in the courses of agriculture. Its value in preserving hay which has been exposed to wet, has been long known, though the salt duties have now in a great measure precluded the use of it.—There is a custom in Spain and Portugal, which I have personally witnessed the practice of in North America, of daily placing on stones in the sheep pastures, some dry salt for the use of the sheep. I have seen each of the sheep in his turn, and with eagerness, take a small portion of it. This is considered as a preservative against the rot, and as contributing to their general health and good condition. It is understood that a considerable part of the salt which we export duty free, to America, is used for the purposes of agriculture; though by the time it reaches the American farmer, it costs him as much as two shillings and sixpence a bushel; and I have no doubt but in our humid and uncertain climate, and in the variety of our soils, it would in small quantities be found generally useful, in preserving our sheep from the rot and other complaints, hitherto deemed inevitable and incurable. In Spain the cows are regularly supplied with a little salt; and the increase of their milk, and the benefit which stable-fed cattle derive from it, are confirmed by many authorities. A Cheshire gentleman informs me, that when he wants extraordinary exertion from his horses, he always gives them a little salt; and this is analogous to the practice in the East, where the camels are allowed salt during the passage of the caravans over the desert to Alexandria, as a support in the extreme fatigue which they undergo.

The advantage of augmenting the number of cultivated acres in this country, would certainly be of great use at present, and would have permanent effects on the in-

crease

crease of employment and subsistence in future. In many instances, however, legislative sanctions would be necessary to enable the parties interested to proceed to exclusive cultivation; but in the millions of acres that surround our coasts, no partition of property, no cultivation of soil is required; we have only to reap what the bounty of Providence has abundantly supplied. The boundless fields are already white for the harvest; and the labourers are standing all the day idle for want of employment,—ready to enter on their task as soon as the financial prohibition is removed. The encouragement of our fisheries has been often in the view of the Legislature; but all their measures have been defeated by the Salt-laws. Bounties, too, have been added, producing little effect, and subject to great abuse; and we have yet to learn, that the effectual and impartial bounty is to leave to the husbandman, the fisherman, the manufacturer, and to all, as far as may be, the free use of that produce which the bounty of Providence has bestowed upon the country. If we really mean that the fisheries should prevail and prosper, as sources of internal supply and external commerce, as providing present employment for our sailors, and future nurseries for our navy—if we desire that the fisherman and cottager on the sea-coast should lay in a winter supply of salt-fish for themselves and their neighbours, we must no longer embarrass them with vexatious conditions, which they cannot understand or comply with; but leave them free to purchase, at a cheap rate, and at the nearest shop, the salt required for curing their fish, and to use it for the benefit of themselves and their country. It has been supposed, that there is already a sufficient allowance of salt for the fisheries, and that it is the fault of those who do not use it: But what sailor, what fisherman, or cottager, can provide

vide what the law requires, proper and secure storehouses for keeping the salt, to be entered with and approved by the excise officer? Who can cure in bulk, or can dry-salt a hundred weight of fish with only fifty pounds of salt, the present reduced allowance? And, even if the full allowance of salt were restored to the fisherman, and the previous condition of the erection and entry of proper and secure storehouses, entirely dispensed with, what uneducated sailor, cottager, or fisherman, could travel through all the different sections of the Acts relating to this subject, the bonds to be given, the annual accounts to be made out, the entries, notices, and permits required, and the penalties and forfeitures in breach of any of the forms prescribed? If an educated lawyer * will

* A recent circumstance has occurred in regard to "the Association for the relief of the manufacturing and labouring poor," where statesmen and lawyers were the acting parties, and every assistance given by Government; and yet all their measures baffled by the interference of a petty excise officer. As this is a case which came within my personal observation, I will briefly state the circumstances. In order to provide relief for the poor under the pressure of scarcity, the sum of £.17,000 was raised by private subscription in the metropolis. Among other measures adopted, a contract was entered into with the North-Sea fishermen, to purchase of them, at the rate of £.18 per ton, all the corned cod which they could not otherwise dispose of; and in the year 1813, six hundred tons of corned cod, and three hundred tons of fresh cod, were supplied and distributed for the maintenance of our own poor, and of the French prisoners then in England. In 1814, the pressure of the scarcity still continuing, the Committee resolved to endeavour to double the supply: they therefore invested the sum of £.2264 11*s.* in the purchase of salt, prepared tanks for curing the fish, and hired double the number of vessels that were employed in the preceding year. When the fishermen were ready to proceed on their voyages, doubts were suggested, and notices given by the excise officer of the district, as to their allowance of salt. An alarm instantly spread among the fishermen; and though, upon the Committee's

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do this, he will see the impossibility of any of the class of labourers and seafaring men, such as I have described, ever taking the benefit of these allowances. But, were the financial fetters of the Salt-laws once removed, we should then see what National Industry and National Enterprise could effect. Our sea-coasts would swarm with adventurous fishing-boats; new means of employment would be afforded to the necessitous and unemployed; new supplies of life would be conveyed into the interior of the island; new sources of commerce be opened to foreign countries, and nurseries of seamen abound on our sea-coasts. No region on earth is so well adapted to the salt-fish trade. We are a naval power: the ocean is our element. We possess a hardy enterprising race of sailors, now grievously suffering for want of employment: we have shoals of fish surrounding our coasts, and an inexhaustible store of native salt, which may be more easily and much more profitably applied in curing fish than by exportation.

Though Manufactures may not supply so great or so desirable an increase of our means of employment as Agriculture and the Fisheries, yet every addition to our Manufactures is a considerable addition to the demand for labour, as well as to the resources of the country;

application to the Treasury, an order was obtained for the Excise to make the full allowance of salt, duty free, yet the terror of pains, penalties, and Exchequer processes, prevailed among the fishermen, and most of them abandoned their contract for the season. In consequence, the quantity of 900 tons, or rather (what might have been obtained but for officious interference) the expected supply of eighteen hundred tons of palatable and nutritious food for the relief of a suffering population, was reduced to 150 tons, being only a twelfth part of what might otherwise have been obtained: the Association was subjected to a heavy loss, and countless loads of fish were lost to the country.

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and here, too, the salt-duties present the same obstacle to progress and prosperity. On two of our manufactures, there is a limited and qualified allowance of the salt-duties —on glass, and oxymuriatic acid for bleaching: but there are articles essentially necessary to our manufacturers, which the salt-duties prevent our making at home; so that we are obliged to purchase from abroad, at much higher prices than we could make them at home. Such are mineral alkali, sal-ammoniac, magnesia, and Glauber salts; which might be made in this country with great advantage, and in great quantities, with a part of the salt which we now export, free of duty. In other manufactures, the effect of the salt-duties is only to injure the English manufacturer, who, for the salt which his works require, must pay a duty of fifteen shillings a bushel on our own native salt, whilst the foreigner has it duty free. To enumerate all the uses of salt, in their various processes for facilitating and improving their operations, would require an intimate and confidential knowledge of the secrets of their manufactories; but it does not require that minute degree of information, to be convinced, that, on all our manufactures (the exports of which exceeded in value, last year, Fifty-three Millions), considering them merely as objects of taxation, the revenue suffers more in them only, from the effects of the salt-duties, than the salt-duties amount to.

Of articles essential to our manufactures, and capable of affording an increase of employment for the poor, in case of the repeal, or allowance of the salt-duties, I shall first notice the article of Mineral Alkali, an ingredient in soap, and in some other of our manufactures. Three tons of salt will make one ton of mineral alkali, the salt, without the duty, costing forty-eight shillings, and, with the duty, ninety-six pounds. The salt-duties, in this in-

stance, are not simply an impediment, but a prohibition; and, in order to obtain this ingredient for soap, &c. our manufacturers have been driven to have recourse to Spain for barilla, the price of which varies very much. During the war, it was as high as 80l. per ton, and is as low as 30l. at present. If salt were allowed to be used, free of duty, mineral alkali could be made of a superior quality, and at an inferior price, from our own salt-works. At the same time, the supply of barilla is very insufficient; and our soap-boilers are generally obliged to use other inferior articles instead of it. This year the importation of barilla, though more than usual, is 6500 tons: but that is only a part of what this country requires for soap, and other manufactures. It is calculated, that there would be an annual demand at home for 20,000 tons of mineral alkali, and that as much more might be immediately disposed of at foreign markets. Such a regular supply at home, would improve the quality of soap, lessen its price, benefit our other manufactures, and afford an advantageous market for 120,000 tons of salt, now sent abroad duty free. It would set all our salt-manufactories to work (many being now shut up), and produce an immediate increase in the demand for labour, not only in the salt-works, and in preparing the new works for making the mineral alkali, and also in making it, but in our other manufactures. It would bear a duty of ten shillings per hundred weight, producing about 400,000l. a year to the revenue. Mineral alkali is an article so useful, that it is hardly possible to anticipate the extent of the demand for it, if the salt-duties were out of the question: and with the spirit, science, and capital of our manufacturers, and our inexhaustible supply of salt and coals at less than sixpence a bushel, our advantages in the manufacture of it would be such as to exclude all competi-

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tion of foreign manufacturers. I am not unaware, that, when this has been suggested, the objection on the part of the Excise has been, that if Government were to allow the use of salt, which pays a duty of 30l. a ton for making mineral alkali, to pay only 10l. a ton, the revenue would lose by it; and that what would be gained by the alkali-duty, would be many times over conceded in the salt-duty. Now, it does not seem to have occurred, that the salt proposed to be used for making this alkali in England, is now exported duty free, for the benefit of foreign manufacturers; and that, if my sanguine wishes could be realized, and 40,000 tons of mineral alkali annually made from 120,000 tons of salt, which would be otherwise sent abroad duty free, the revenue would gain 400,000l. a year, where it now reeeives nothing; the country would save nearly as much more of money now remitted abroad for the purchase of barilla; our manufactures and export trade be augmented; the salt proprietor obtain a better market; the demand for labour be inoreased; and the public greatly benefited.

Another similar instance occurs in the making of Sal Ammoniac; an article necessary to our manufactures, and hitherto imported at a considerable expense. This is so useful in working metals, that not less than twenty tons of sal ammoniac are annually used by workers of metals in Birmingham only. Our chemists lately discovered a process for making it from common salt, not only at much less expense, but of a superior quality; but the excise-officers soon found out, that the salt used in this process was liable to the full duty. Baffled, however, in this, the manufacturers made another effort, by adopting a process for making sal ammoniac from the bittern of common salt-works, which is otherwise waste and refuse; but here again the excise-officers interfered, and decided,

that

that the code of salt-laws prohibits this bittern to be converted to any such use, without payment of a duty that amounts to a prohibition. In the consequence, foreigners have made use of our own discovery, to establish manufactories of sal ammoniac in France and Germany. In North Britain, however, the use of this bittern is allowed by Government, and sal ammoniac is making from it in many parts of Scotland.

During the process of making common salt, it would be easy to separate the magnesia, and thereby greatly to improve the quality of the salt for curing fish and animal food, and at the same time to produce quantities of magnesia for exportation; but the effect of the salt laws is to prohibit the use or sale of magnesia so obtained. As to Glauber salts, the salt duties have had a still more injurious and vexatious operation. I have observed, that there is an allowance of the salt duties for making oxymuriatic acid for bleaching. In preparing this, there is a considerable residuum which had been thrown away. To prevent this waste, a gentleman in Lancashire constructed a large apparatus, consisting of boilers and crystallising vessels, and succeeded in producing from this residuum many tons of very fine Glauber salts, on which he paid to the revenue the then existing duty of 30*l*. a ton. "Government, however," says Mr. Parkes, (from whom I transcribe the fact,) "has forbidden the sale of the residuum; and, consequently, this extensive apparatus has become useless." In these, and other articles of manufacture, though the increase of the demand for labour may not be so considerable as in husbandry and the fisheries, yet if the total amount of what would be added to our manufactures by the repeal of the salt duties, be fairly estimated, with its consequences in the increase of commerce, and of the trades and occupations connected

with

with manufactures and commerce, we shall find a considerable and immediate addition would be thereby made to the sources of employment.

It must indeed astonish foreigners, that an immense prohibitory impost should be laid on an article of British produce, essentially necessary to our manufactures, agriculturists, and fishermen; whilst Ireland and Scotland are burthened in a lesser degree, and France, and Spain, and all the rest of the world are entirely free. Very different is this from the policy of ancient governments, recognised by the greatest and highest authority: "Of whom do the kings of the earth take custom or tribute? of their own children, or of strangers?" "Of strangers." —"Then are the children free."—But with us, and by our laws, the strangers are free; and the children are taxed to forty times the value.

The imposition of a tax, so far beyond the real value of the article on which it is imposed, inevitably leads to strictness and severity of language in the regulations respecting it; and notwithstanding all the pains, penalties, forfeitures, and restrictions, which have been so lavishly bestowed on these acts, payment of the duty is very frequently evaded. Taking into consideration the increase of price charged to the consumer, where an excessive tax has been previously advanced, and that this increase of price is also applied to stolen salt which has paid no duty at all, there will be little doubt but that the consumer pays twice the amount of what is received on account of this tax into his Majesty's Exchequer. This, however, is a minor consideration to that of the pernicious effects which it produces on the moral character of the labouring class. The temptation of forty times the original value, on a necessary article of life, becomes so great as to affect their principles, and to convert honest

men

men into scurvy knaves. Thievery, and its concomitant vices, prevail in the neighbourhood of great salt-works, to an alarming degree. The salt is of so little value to the proprietor before the duty is paid, and is of so much value to the thief who evades the duty, that this kind of petty plunder is carried on to a considerable extent; so that many farmers in the neighbourhood have a regular supply of salt at very reduced prices, periodically brought to their houses, to cure their bacon, salt their cheeses, and for other domestic purposes. This generates thievish habits among the labouring class, and prepares them for atrocious crimes. Two young men, who were executed a few years ago in Cheshire, for defending their plunder by shooting at an exciseman, and who appeared to be by far the least culpable of their gang, confessed at the gallows, that petty thefts in salt-works, were the origin and cause of their criminal habits, and of the unhappy termination of lives which might otherwise have been a blessing to the community.

Agricultural Experiment.

THE Oat Grub having committed very extensive depredations during last spring in several parts of Scotland, Mr. Brock, an agriculturist of West Lothian, has recently communicated to the Editor of an Edinburgh paper, the uniform result of a method which he was led to try, a few years ago, to check the ravages of that destructive insect, and which appears from his testimony, and from the natural qualities and natural cheapness of the article employed, to be deserving of repetition by agriculturists in general.

"More," says he, "for the sake of experiment, than with any hope of success, I mixed a little common salt

with the seed, which I knew, if it did not answer the end proposed, would at least act as a good manure; but the result was beyond my expectation. The season was such as the last, all around me suffered from the Grub; and I had, where the seed was not so treated, fields much injured. But so far as that seed went, *there was not a stalk to appearance touched.*

"In order to be sure that this could be owing to nothing but the effect of the salt, the next season I sowed part of the same field with seed without salt, and part with it, carefully marking the several parts; the seed also was of the same kind and quality; and at harvest every ridge where the salted seed was sown could be distinctly pointed out, by its abundance, independent of the marks I had made, while the rest of the field was greatly injured and deficient. I have since continued the practice, carefully varying the circumstances; and the result has been a thorough conviction on my mind, that if it is persevered in, success cannot fail to attend it."

Mr. B. states further, that the quantity of salt he employs, compared with seed, is only about the proportion of one to thirty-two; and there are many persons of character whom he could name, if required, who can vouch the facts above related.

On the Use of Straw Ropes in protecting Fruit-tree Blossom, &c. from late Frosts.

By Mr. JAMES LAIRD, *Gardener at Portmore.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

AS soon as the buds of the trees become turgid, I place poles against the wall, in front of the trees, at from four to six feet asunder; thrusting their lower ends into

the earth, about a foot from the wall, and fastening them at the top with a strong nail, either to the wall or coping. I then procure a quantity of straw or hay ropes, and begin at the top of one of the outer poles, making fast the end, and pass the rope from pole to pole, taking a round turn upon each, until I reach the end; when, after securing the end well, I begin about eighteen inches below, and return in the same manner to the other end, and so on, till I have reached to within eighteen inches or two feet of the ground.

The above method is both cheap, and, so far as I have experienced, very efficacious; and as it does not much interrupt the rays of the sun, it may be applied early, and allowed to remain till the middle or end of May, according to the state of the weather.

The first season I tried the above method was in 1802. I had covered a peach-tree, on a wall where were many others. On the 5th of May there was a heavy fall of snow, and on the morning of the 6th the thermometer stood at two degrees and a half below the freezing point. The consequence was the loss of the whole crop, except a few that were protected by the foliage. But the tree that was covered and protected, produced a fine crop.

I have also found straw-ropes to be very useful in protecting other early crops from the effects of frost, as peas, potatoes, or kidney-beans, by fixing them along the rows with pins driven into the ground.

I have also sometimes used old herring-nets, and at other times branches of evergreens, for the protecting of blossom; but I have not found any of them so efficacious as the above. Besides, straw-ropes are much cheaper, and may be obtained in every situation.

On

On the Preparation of Flax and Hemp without Steeping.

Abstract of an Act of Parliament,
Dated July 2, 1813,

FOR securing to James Lee and the Public the benefit of his invention of certain new methods of preparing hemp and flax, by enabling him to lodge the specification under certain restrictions.

English Patent, dated 9th June 1812.
Scotch ditto ...... 8th Aug. 1812.
Irish ditto ...... 14th Aug. 1812.

Whereby it is enacted, that the specifications of each Patent be delivered to the respective chanceries of the three kingdoms within fifteen months from the date of each Patent, and to remain locked up for seven years, from the 2d July 1813, being the date of the Act authorizing them to be so secured; but subject to the inspection of the Chancellors of England and Ireland, and Chief Baron of Scotland, in case applications should be made for a Patent or Patents for a similar invention, or in case any suit at law should take place respecting the aforesaid Patents.

In consequence of what passed in Parliament at the time the above Act was obtained, on the probability that the invention would get abroad, and be practised there before his Majesty's subjects could lawfully use it, and which it was thought might tend to diminish the benefit which the linen and hempen manufactures of the United Kingdom might otherwise derive therefrom, the Conductors of this Work have hitherto refrained from giving any account of the invention; but this conduct has not been pursued by other journalists, for the following ac-

count of it was given in an English journal, so long ago as Sept. 1815, and copied into the French journals immediately after. And notwithstanding the French paper (which we also insert under this head) affects to consider the accounts obtained in France as vague and imperfect, yet it appears that these have been sufficient to turn their thoughts to the accomplishment of the same object. This shews the futility of locking up the specifications of Patents by Act of Parliament; and, indeed, if it were possible to prevent the public from obtaining any knowledge of the invention for the whole term that the Legislature enacts it, that would still be but a mere speck to the long period that must follow, in which the whole world will participate in its benefits.

The Conductors consider it their duty to state these circumstances, that their work may not suffer in the opinion of their readers for wanting that information which the Legislature thought (whether just or otherwise) proper to be withheld; and they now think it right to give, in the order in which they have appeared, first, the English account of Mr. Lee's invention; then the *Report of the Committee of the House of Commons relating to machinery for manufacturing Flax and Hemp*, with Mr. Millington's evidence before the Committee, which comprises the object of the invention; and, lastly, the French paper, which describes a machine invented and constructed in France for the same purpose.

English Account of Mr. LEE's *Invention of a new Mode of manufacturing Hemp and Flax, published in* 1815.

About two years ago Mr. Lee took out a Patent for obtaining hemp and flax directly from the plant, by a new method. He has establis heda manufactory for the

new

purpose at Old Bow, on the river Lea, near London, where his method, and the result of it, may be seen. The Editor of that Journal considers Mr. Lee's invention as the greatest improvement ever introduced into the linen business, and as likely to occasion a total change in the whole of our bleach-fields. Hitherto the only way of obtaining hemp and flax has been to steep the plants in water till they begin to rot. They are then exposed for some days to the sun, spread out upon the grass, after which the woody part, now become very brittle, is removed by the flax mill, the nature of which is too well known to require description. By these processes the fibres of the flax are weakened, and a considerable portion of them is altogether destroyed and lost. The flax too acquires a greenish yellow colour; and it is well known, that a very expensive and tedious bleaching process is necessary to render it white. Mr. Lee neither steeps his flax, nor spreads it on the grass. When the plant is ripe it is pulled in the usual way. It is then thrashed, by placing it between two grooved wooden beams, shod with iron. One of these is fixed; the other is suspended on hinges, and is made to impinge with some force on the fixed beam; the grooves in the one beam corresponding with flutes in the other. By a mechanical contrivance, almost exactly similar, the woody matter is beaten off, and the fibres of flax left. By passing these through hackles, varying progressively in fineness, the flax is very speedily dreseed, and rendered proper for the use for which it is intended. The advantages of this method are manifold. The expense of steeping and spreading is saved; a much greater produce of flax is obtained; it is much stronger; the fibres may be divided into much finer fibres, so as to obtain at once, and in any quantity, flax fine enough for the

the manufacture of lace. But the greatest advantage of all remains yet to be stated. Flax, manufactured in this manner, requires only to be washed in pure water in order to become white. The colouring matter is not chemically combined with the fibre, and therefore is removed at once by water. It is the steeping of the flax and hemp which unites the colouring matter with the fibres, and renders the subsequent bleaching process necessary. Thus, by Mr. Lee's process, flax and hemp are obtained in much greater quantity, of much stronger quality, and much finer in the fibre, than by the common method, and the necessity of bleaching is altogether superseded. The great importance of such an improvement must be at once obvious to every one.

Report of the Committee of the House of Commons on Petitions relating to Machinery for manufacturing of Flax.

Dated May 23, 1817.

The Committee to whom the Petition of Samuel Hill and William Bundy, and also the Petition of James Lee, were referred; to report the same, with their observations thereupon, to the House;—have examined several witnesses in support of the allegations of the said Petitions, and agreed upon the following Report:

Your Committee, in obedience to the directions of the House, proceeded to take into consideration the Petition of Messrs. Hill and Bundy, on their improved method of preparing flax and hemp, in a dry state, from the stem, without undergoing the former process of water-steeping or dew-rotting.

Your Committee received satisfactory proof that the preparing flax and hemp, in a dry state, for spinning, answered

answered most completely, and was likely to prove a great and valuable improvement, both to the grower and manufacturer; the cost of preparing being less; avoiding the risk of steeping, which is considerable; a great saving also in time and material.

It was proved also to your Committee, that the strength and quality of cloth manufactured from flax thus prepared, are much superior to that produced from flax which has been water-steeped or dew-rotted.

Your Committee are fully impressed with the great national advantages likely to result from this discovery, by which it would appear, that a saving in the proportion of ninety to thirty-three would be obtained on the annual growth of flax in the empire, computed at 120,000 acres, affording an increase of employment to many thousands, and an augmentation of the national wealth to the amount of many millions, as will more fully appear by reference to the evidence in corroboration of the allegations set forth by the said Petitioners.

It appeared also in evidence before your Committee, that the flax prepared by Messrs. *Hill* and *Bundy's* machines was superior to any dew-rotted flax; and that large orders had already been given for flax thus prepared, by the house of Messrs. Benyon and Co. at Leeds, one of the most considerable manufacturers of flax in the kingdom.

Your Committee proceeded also to the consideration of the Petition of *James Lee*, but did not feel themselves competent to go into any examination of the allegations, stating an infringement of Mr. *Lee's* Patent. As far as the evidence before the Committee was adduced, it did not seem to justify such an assumption. This, however, is a question for a Court of Law.

Evidence on the part of Mr. *Lee*, was produced to your

your Committee, to shew Mr. *Lee's* machines were in use, in various workhouses, in different parts of the kingdom; that Mr. *Lee's* manner of preparing flax was without water-steeping or dew-rotting; and affords additional proof of the great advantages of the practice.

Your Committee must also call the attention of the House to the essential benefit that will be derived to the cultivators of flax, from the quantity of valuable food for cattle, obtained from the new method of preparing flax.

It has been given in proof, that the boon or outer coat of flax, contains one-sixth of the gluten of oats.

Mr. JOHN MILLINGTON'S *Evidence.*

What are you? I am professor of mechanics at the Royal Institution.

Have you seen Messrs. *Hill* and *Bundy's* machines at work, preparing flax and hemp for the spinner? I have.

What is your opinion of the effects produced by the breakers, in the first process?

It seems to answer the purpose of taking off the boon or woody part from the flax: I observed that this was pretty effectually done by once passing through the machine, which consists of five rollers. I accurately weighed myself (first adjusting the scales, and seeing that they were correct) one avoirdupois pound of the stem or flax in its dry state, as it comes from the farm; it required five minutes to pass this through the machine, but I took care not to let the man know I was timing him, lest he should make an extraordinary exertion, and he seemed to be working at the ordinary rate which he could continue to work for a length of time. I found upon weighing the product when it came from the machine, there

 was

was a loss of nine ounces and three-eighths; consequently six ounces and five-eighths of useable materials were obtained, that is, of fibre or harl, as it is called generally.

It was then passed through the second machine, called the rubber or rubbing-machine; this required eight minutes for the quantity which was left: the result of this was, four ounces and a quarter of harl or fibre in a clean state, fit for the hackle; some gentlemen present observed, that it was scarcely clean enough, and it was passed through a second time; we divided the quantity into two equal parts, and the second process took three minutes, but if the whole quantity had been used, I do not think it would have required more exertion. The whole process for the pound took sixteen minutes, and the loss upon weighing it, after the process, was exactly three-fourths without a fraction; so that there was one-fourth of very good and soft fibre produced, fit for the hackle.

How far are you of opinion, that the hackling process completes the material for the spinner?—I have seen the process of hackling by the hand; and I have likewise seen the model of hackling machinery, invented and made by Fenton Murray and Wood, of Leeds, which by certificate sent to the Society of Arts, appears to be the best machine that had ever been constructed up to that time. I certainly conceive this to be a still better improvement upon theirs, but at the same time I think the machine, as it now stands, would admit of further improvement as to velocity; it appears to me to do its work very well, but I have my doubts whether in its present state it will do that work with sufficient rapidity.

What quantity do you suppose a man will be capable of doing in a day?—That will be answered by a prior calculation which I made when there were one man and a

 boy

boy at work; but at the same time I ought to state, I tried the power, and it was nothing like the power of a man; one man might with facility turn several such machines, though each would require a child to attend for the purpose of feeding and taking out the product.

What is your opinion as to the machine being liable to be easily put out of order?—I do not conceive it is subject to get out of order; the rubbing machine will no doubt be subject to considerable wear in the rubbers, but those merely consist of little pieces of beech wood, which may be replaced at any time, by any carpenter in the neighbourhood where the machine may be, without applying to the patentees.

In case of any accident to the machine, could it be easily repaired by a common blacksmith?—With the exception of the breakers, I do not think they are likely to get out of order myself.

Is not turning three machines too much for a man? —I do not conceive it is at all.

Children may supply the rest of the work?—Certainly, without doubt.

Have you made any experiments, as to the nutritive quality of the chaff?—I have not myself made the experiment, but I required Mr. Brande, who is professor of chemistry at the Royal Institution, to make the experiment, and I have seen the analysis myself going forward; the result was obtained only this morning; and it appeared to be one-eighth of actual nutritious matter from the quantity experimented upon. Another quantity, which appeared to have been materially injured by the weather, but which must be explained by some other witness, for I do not know how it came so, yielded one-twelfth of nutritious matter; that appeared to me as of the worst quality, and as if it had been subject to wet weather,

weather, and had a portion of its nutritive matter washed from it.

Would not that that had gone to seed have less nutritious matter than that taken before seeding?—Yes.

Do you know the quantity of nutritious matter in straw and hay?—I have not had an opportunity of trying it.

Is there any oil in it?—We have not had an opportunity of examining it; but I expect there is, and the general idea of oats is that there is about one-fourth part of waste, taking it altogether; that the oat itself contains three quarters of nutritious matter, and one quarter in the shell and waste.

It is probable, therefore, that this chaff must be a nutritious food?—If this is the case, the nutrition would be about six to one; that it would require six pounds of this to render nourishment to a horse, equal to one pound of oats. Mr. Sewell, of the Hounslow Flax Mills, informed me, that he had been in the habit of offering it to his horses, and that when they were accustomed to it, they would leave clover chaff to come to this food.

Are you of opinion that Messrs. Hill and Bundy's machine may be of use to farmers and cottagers, at their own homes?—I should conceive in answer to that, that the machine would be too powerful and expensive for small farmers, but that they would be highly beneficial if they were introduced in districts; for instance, in a workhouse or any parish establishment, where eight or ten such small farmers might have access to them.

Have you seen the calculations made by Mr. Hill, respecting the number of people that might be employed, if those machines were general?—I have seen those calculations.

What is your opinion of them?—I believe they are correct, with the exception of one circumstance; I cal-

 culate

culate the quantity taken in his pamphlet, is rather under what I take it myself. On a supposition that there are 120,000 acres of flax and hemp annually grown in Great Britain and Ireland, and that on an average three tons of stem are produced, from this number of acres will be

	360,000 tons
By the operation of Messrs. Hill and Bundy's machines, one quarter of the above quantity is obtained in fibre, or	90,000 tons
But by the old process of dew-rotting, only one-eleventh part of the above 360,000 tons is procured, or	32,727 tons
Giving an excess of fibre saved by the new process, from the same number of acres, amounting to	57,273 tons
	20 cwts
	1,145,460
	112 lbs
	2,290,920
	1,145,460
	1,145,460
This number of tons when produced in pounds, gives of fibre or flax, hemp and tow	128,291,520 lbs.

Now, as on an average it will require half a pound of flax to the yard of linen cloth, this number of pounds would annually make 256,583,040 yards of linen cloth from the additional quantity of flax, hemp, and tow, procured from the same number of acres grown. This quantity of linen cloth selling in the shops, on an average of 2*s.* *per* yard, would give an annual increase to our national

tional wealth, from the same number of acres employed in this cultivation, of £.25,658,304. Exclusive of the cost of the raw material, and the expenses of preparing it by Messrs. Hill and Bundy's machines, the expense for spinning and weaving it into linen goods, is taken at £.32 17*s.* 8*d.* *per* ton. This cost of labour on the quantity of flax, hemp, and tow, saved by the operation of these machines, namely, 52,273 tons from the 120,000 acres, would amount to 12,114,747 £. 2*s.* and which would yearly give employment to 807,649 persons, calculating the value of the labour of each at 1*s.* *per* day the year round, and estimating them to work 300 days in each year. This average will not be considered too low, when it is considered that a large portion of the labour is performed by women and children.

Are you acquainted with Mr. Lee's machine intended to effect a like purpose with those of Messrs. Hill and Bundy?—Not particularly; I saw a machine or set of machines which I was informed were Mr. Lee's, at St. Pancras Workhouse, about three, four, or five months ago; those consisted of a scraping machine, lying horizontally, the flax was held by one hand and drawn through this machine, while the presser having teeth in it was worked by the other hand; there was also a swinging machine; I do not know the names by which he designates his particular machines, but it appeared to be precisely the same as the machine which is now in the room. I enquired particularly at that workhouse whether that was the whole process, and was informed it was all they knew of; but Mr. Lee has this day shown and explained his machine to me; I find the same two machines which I before saw, namely, the horizontal and vertical machine, and in addition to that, the machine consisting of fluted rollers, which I had not before seen. I have like-

wise

wise this day seen some flax passed through the several machines, with the exception of the horizontal machine; I did not see that used, but the woody matter appeared to be very well separated by the swinging machine; it was afterwards cleared by passing the fluted rollers, in a skain formed by passing one end into the other, so as to make a perpetual revolution, and this seemed to me to answer the purpose as effectually as the machine of Messrs. Hill and Bundy; it produced the same end, though by a different process. I am not, however, prepared to state the difference in them, though I have no doubt the loss or gain would be precisely the same. Mr. Lee then passed a portion of flax stem through the fluted rollers, without the operation of the beating machine; and this, I must confess, did not to me appear to answer the purpose of separating the woody part from the fibres; it was merely broken into short pieces, but it did not peel off or leave the fibre.

Do the machines of Messrs. Hill and Bundy resemble those of Mr. Lee?—I do not, myself, speaking candidly, see any similarity. The operation of Hill and Bundy's first machine is different from a regular revolution by rollers, inasmuch as an alternating motion is produced, and there is such a distance between the teeth in their machine, that the woody matter has an opportunity of escaping; while, on passing through the rollers of Mr. Lee's machine, it appears to me to be compressed upon the fibre, instead of separating it.

Have there ever been any machines in use prior to Mr. Lee's, for the purpose of dressing flax in this manner?—I am not certain that flax has been dressed by the dry process; but the old machine which has been in use for a great length of time, approximates very closely to both the beating machines of Mr. Lee. The swinging machine

chine is exactly similar to a machine of Mr. Bond's, deposited in the repository of the Society of Arts, except that his works in a nearly horizontal direction, while that of Mr. Lee's works in a vertical one. I have never, till lately, paid much attention to the operation of dressing flax: but having had occasion to notice that subject in my lectures at the Royal Institution, I have investigated the different processes as far as I was able to obtain information from books and inquiry, and it does not appear to me, that the process of breaking by tooth rollers moving with a regular continued motion, is new, inasmuch as that is described in an old edition of Chambers's Cyclopedia.

Do you conceive those two machines to be likely to produce great national advantages?—I certainly think, that as far as employment of the poor can produce that, they do hold out very reasonable and fair ground for supposing that a novel branch, or rather an extended branch, of manufacture may be introduced into this country, by the improved process of manufacturing flax. There is a great prejudice existing in the country, among farmers, from the circumstance of flax making no return to the land; it is unlike other crops, inasmuch as it is pulled up by the root, instead of being cut, and by the old process, all that was nutritious in it was wasted or washed away by the process of water-steeping; whereas, from the analysis which has just been mentioned, it appears that if the product should be wanted for food, that flax is as capable of making a return to the land as any other crop. Another material advantage in the present process, is, that instead of the flax becoming ripe at nearly the time of corn harvest, and requiring to be attended to immediately, it may now be dried in the same manner as hay, and laid up in barns, so as to afford winter employment

ment to farmers' servants and others, at a season of the year when such employment very rarely exists in any other form. It would therefore enable the farmer to keep a greater number of servants, with advantage to himself and to the other parts of his farm, than he could want to do if he did not encourage this kind of culture.

It would be highly beneficial also in wet weather?—Yes, it would afford means for employment in wet weather.

Have you any mode of calculating the expense of the old process, compared with what it would be by the improved system?—I have not.

You said it would require 16 minutes to pass through both machines, separately; would not both machines work at the same time?—Certainly; but it would require preparation between the two processes; there is no doubt but that the two machines might be working at the same time, though, as this was an experiment upon a particular quantity, one machine was standing idle while the other was in use.

Then a pound might be done in eight minutes?—A pound would be done in eight minutes, and part of another pound begun; because part would have passed a second machine, and you would have had a lapse of three minutes upon the second machine.

What you speak of is a pound of rough material?—A pound of flax in its dry state, as it comes immediately from the farm.

How many pounds of flax could be produced in twelve hours, and by what number of hands, by the machine?—Twenty pounds, by one man and two children.

Would that machine require the full power of a man, or could he work more machines than one?—He could work two machines with three children.

Then

Then the three machines would require how many hands?—One man and three children.

They would do sixty pounds?—Thirty pounds, 20 pounds the pair of machines, and 10 the other machine.

Would a man be able to continue 12 hours driving that machine?—Not 12 hours, because 12 hours has always the interval of dinner, and so on; 10 hours is usually a day's work.

Could he work that?—I have no doubt he could; I have known men work 10 hours at more laborious work than this.

Have you seen the flax-dressing machine employed?—I have; and I have stated respecting that, that it went too slow.

Do you know the quantity it would dress in two hours?—No, I do not.

Do you know the waste?—The waste on what I saw was very little; I merely saw one handful passed through it, and the waste was not a fortieth, I should think, but it was not weighed.

A very trifling waste?—Yes, I do not myself conceive the machine to be in its perfect state.

Is Mr. Lee's or Messrs. Hill and Bundy's the most simple?—Certainly Mr. Lee's is the most simple.

Do you apprehend that Mr. Lee's being the most simple, is less liable to be put out of order?—Certainly it is.

That part of Messrs. Hill and Bundy's that is more liable to be put out of order, consists of beech-wood that could be put in order again by any common carpenter? Except the rubbing part that contains wheels, and some degree of intricacy.

With regard to the rollers, they are not liable to be broke?—I conceive not; the only part which would be

 subject

subject to wear, is the pivots on which they turn, and they could be replaced very easily.

Mr. Lee's machine, you said, had not the effect of separating the woody part from the fibres?—The beating process separated it most effectually, but not the rollers; and I ought in justice to say, that Mr. Lee told me that that arose from the flax not being sufficiently dry; and I then had Mr. Lee's assurance that it would answer if dry.

Do you suppose the small rolling machine of Mr. Lee's would complete the business well, if the flax had been good or formed into a skain?—I should doubt it very much; without the application of the breaking machine.

Will not the rollers in Mr. Lee's Patent tend to divide the fibres, and render the flax finer when it is brought to the hackle?—Certainly; any pressure upon the stalk of the flax so regulated as to cut the fibre, will tend to spread, or open it, and make it finer; but that is equally well answered in the rubbing process, for there it is spread: and in the other machine, a simple roller without fluting would answer that purpose.

On the Preparation of Flax and Hemp without steeping.

From Les Archives Philosophiques Politiques et Literaires, No. 2.

It is three or four years since Mr. Lee in England discovered the means of preparing flax and hemp without steeping. He obtained a patent of which the specification was kept a secret by order of the government. Mr. Lee raised and authorized the establishment of several manufactories founded upon his processes, which appear to have been very imperfect in the beginning.

Last year Messrs. Hill and Bundy conceived and executed

cuted another system of preparation which is affirmed to be much preferable to Mr. Lee's method. They have also obtained a patent*, and the government has forbid its publication †; so much do they believe it the interest of England to enjoy exclusively the process, the results of which are of such great importance to European industry.

The French government, which suffers nothing to escape that can contribute to the national prosperity, has ordered researches on this subject to be undertaken at the Conservatoire Royal des Arts et Metiers; and M. Christian, director of this establishment, has bestowed upon it all the attention that it merits; but, instead of seeking to find out the mode employed by the English upon the imperfect accounts that have reached France, and to grope in their footsteps, he treated it as a question entirely new and unsolved, and his efforts have been rewarded with complete success.

The new method employed by M. Christian is very simple and expeditious; it can be used every where; it requires neither apprenticeship nor much expense, it is in a manner within the compass of any fortune, and, as far as they can be compared, it is at least equal to the best English system.

The minister of the interior has not hesitated to ordain its publication. It belongs to France to give this novel example of disinterestedness. It is time that a simple post, the course of a river, an arm of the sea, a chain of mountains, should no longer break the ties that ought to unite mankind, and that we should no longer stifle the noble sentiment of reciprocal good will.

* Mr. Bundy only has obtained a patent.

† This is not true: the English Government has not forbid the publication of Mr. Bundy's specification.

The writer of the paper here gives a history of the ancient and modern modes of preparing these plants up to the period of Mr. Lee's discovery, commenting at the same time on the disadvantages attending the operation of steeping. He then proceeds to give the substance of Mr. Millington's evidence, and goes on as follows: This evidence of Mr. Millington's is the principal account that France has obtained relating to the new English processes, and although we do not find in it an explicit detail either of the precise form of the machines, of their particular construction, or of the manner in which they are employed, we can at least appreciate the double system, and compare it with the process discovered in France, and which is entirely different from those of Mr. Lee and Messrs. Hill and Bundy.

It would not be difficult, however, to cause machines to be constructed according with the above-described systems, and to arrive at the same results as the English, notwithstanding the imperfect description given in the report of the Committee, but we believe our own method is preferable in many respects.

In order to ~~reduce the flax~~ or hemp from the state in which it is gathered to the point proper for hackling, three distinct operations are requisite, which we are able to execute in a manner simultaneously, or at least by the same machine; that is to say: 1st. To flatten the stalk, and to break the woody matter into small pieces lengthways: 2d. To crack the woody matter into small pieces again in a cross direction, and to separate them from the fibres: and, 3d. To divide and soften the fibres. We obtain these three effects completely by a single machine composed of two pair of fluted or grooved cylinders, to which are communicated by a handle different degrees of velocity, with a double train.

The

The first pair, which we shall call the *feeding cylinders*, are of iron, of a small diameter, and are fluted longitudinally with angular flutes, not sharp. The second pair, which we shall call the *combing cylinders*, are of wood, with iron axles, the flutes or grooves are parallel to the axis, and can be taken off and replaced at pleasure. The grooves are of hard wood, but the edges are covered with plates of iron cut perpendicularly to their length into small flat teeth, rounded at the top, and polished on every side; these plates are fitted firmly to the upper part of the grooves, and they are so arranged that lightly fitting one into the other their lateral faces rub one upon the other, and do not suffer the plates of iron to touch the wood upon any point in the course of the revolution of the cylinders. The flax stems are distributed parallel and equally upon a board, and kept in this position transversely by a piece of wood that supports a spring. The points of the flax stems are made to enter the feeding cylinders first, which flatten and begin to break them according to the thickness of the cylinders. These cylinders make one turn while the combing cylinders make fifteen or eighteen; the little teeth of these cut the outer coat longitudinally, and gradually detach it from the fibres. The fibres are softened and divided by the rubbing of the surfaces of the grooves, and by the action of the small teeth, in the rapid rotation of the combing cylinders. Thus we see that the fibres of flax or hemp come from the combing cylinders entirely separated from the outer coat, divided, softened, and ready to be hackled for making ropes or ordinary linen. The operation is entirely terminated in one minute.

Flax and hemp may be brought to the utmost fineness by taking them from the combing cylinders, washing them in cold water, and immersing them for two or

three hours in water slightly acidulated with sulphuric acid, in which they become white, and acquire a great degree of fineness. They are dried and softened on the same machine, having in the place of the combing cylinders two cylinders of the same form, but the plates of iron on the grooves are rounded instead of being toothed: lastly, they are hackled, and the fibres of flax and hemp come from this supplementary operation white, silky, and fit for making the finest linen and lace. We obtain the same products from given quantities as the English do, never less, and sometimes more, but the quality of the flax has great influence in this respect. Our process is extremely simple. The machine is easily constructed and not expensive, it is even of small bulk. We propose to enter into the details of its construction, and to give an engraving * of the machine in one of our next numbers, although what we have above stated is sufficient for an intelligent artist to execute it with facility. We cannot conclude without observing, that it is certain that the French process, as it is now executed at the Conservatoire Royal, yields in nothing to those of the English, if it is not superior; that, besides, we shall probably be below the truth in supposing that we cultivate in France as much flax and hemp as they do in England and Ireland; that we may apply to our own position all that is true and accurate in the calculations of the English, and that we may consider the discovery as even more important to France than to England.

* We shall take an early opportunity of giving this engraving when we receive it.

New

New Process for preparing Alumine.

By M. GAY LUSSAC.

From the ANNALES DE CHIMIE ET DE PHYSIQUE.

PURE alumine is usually prepared by the decomposition of alum by ammonia or potash, and by washing the precipitate until the lessive waters cease to precipitate solutions of barytes. This process requires much time, because of the slowness with which the alumine is deposited, and it is very rare that this earth is obtained very white and in a great state of division. These difficulties have hitherto impeded the use of alumine, and it may perhaps be rendering a service to the arts to point out a quick and easy method of obtaining it perfectly pure, and in as great a quantity as can be desired.

This method consists in taking alum with a base of ammonia, and which is now to be had in abundance in commerce. In calcining it, in order to deprive it of its water of crystallization, and afterwards decomposing it in a crucible at a red heat; the sulphuric acid and the ammonia are thus disengaged, and the alumine alone remains in a state of the greatest purity.

This earth, when thus prepared, is very white, soft to the touch, and of extreme tenuity. It combines easily with water, but at a gentle heat it separates from it, and resumes its properties, as M. Saussure has already remarked. Its great division and the hardness of its molecules may render it useful in polishing metals; and from its whiteness it may also probably be employed in the fabrication of colours.

List of Patents for Inventions, &c.

(Continued from Page 256.)

JAMES MASON CHAMPNESS, Whitesmith, and HENRY BINKS, Clock and Watchmaker, both of Cheshunt-street, Hertfordshire; for certain improvements on axle-trees of carriages of various descriptions. Dated August 28, 1817.

JOSEPH MANTON, of Davies-street, Berkeley-square, in the parish of St. George's Hanover-square, Middlesex, Gunmaker; for certain improvements in locks for fire-arms. Dated September 26, 1817.

JOHN DALE, of White Lion-street, Pentonville, Middlesex, Millwright; for the application of a certain material, hitherto unused for that purpose, to the making of rollers or cylinders of various descriptions. Dated October 3, 1817.

WILLIAM HARRY, of Morriston, near Swansea, Glamorganshire, Smelter of Copper Ores; for an improvement or improvements in the building, constructing, or erecting the roofs or upper parts of furnaces used for the smelting of copper and other ores, or any of their metals, or for any other purposes requiring strong fires. Dated October 3, 1817.

JOHN OLDHAM, of South Cumberland-street, Dublin, Esquire; for an improvement or improvements in the mode of propelling ships and vessels on seas, rivers, and canals, by the agency of steam. Dated October 10, 1817.

END OF THE THIRTY-FIRST VOLUME.

INDEX

TO THE

THIRTY-FIRST VOLUME, SECOND SERIES.

A

B

H

I

J

K

L

M

N

O *Oaks,*

O

P

R

S *Salt-*

S

T

V

W

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